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THE
BOTANY OF BIHAR
AND ORISSA

AN ACCOUNT OF ALL THE KNOWN INDIGENOUS
PLANTS OF THE PROVINCE AND OF THE
MOST IMPORTANT OR MOST COMMONLY
CULTIVATED EXOTIC ONES

WITH MAP AND INTRODUCTION

BY

H. H. HAINES, C.I.E., F.C.H., F.L.S.

LATE CONSERVATOR OF FORESTS, BIHAR AND ORISSA

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PART III

CALYCIFLORÆ

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FAM. 52. MORINGACEÆ.

Trees with alternate 2-3-pinnate deciduous leaves with small leaflets, stipules 0, but glands usually present at the base of the leaves and leaflets. Fls. m.s., zygomorphic, 2-sexual, white or red in many-fld. axillary panicles. Sepals, petals and stamens inserted on the margin of the disc which lines a cupular hypanthium, perigynous. Sepals petaloid reflexed narrow. Petals somewhat unequal, two upper erect, the others reflexed. Stamens in two whorls with somewhat unequal filaments, the episepalous ones more or less reduced to staminodes, anthers 1-celled, introrse. Ovary on a short gynophore, 1-celled, with 3 parietal placenta and terminal style. Ovules numerous, 2-seriate on each placenta, pendulous anatropous with ventral raphe. Fruit pod-like, 3-6-angular and 3-valved, seeds along the centre line of each valve, separated by corky protuberances, 3-winged or wingless. Embryo straight with thick cotyledons, radicle superior, plumule with several leaf-rudiments, albumen 0.

1. MORINGA, Juss. (The only genus.)

1. *M. oleifera*, Lamk. Syn. *M. pterygosperma*, Gaertn. Munga ara, M.; Sojna, Sohajna, H., Beng.; Mungha, Or.; Horse-radish tree.

A small tree with elegant 3-4-pinnate leaves, pubescent or tomentose when young, and small elliptic or ovate leaflets 2-9" long, pale beneath. Panicles tomentose, branches 6-9" long. Fls. white, 1". Capsules pendulous, 9-18" long, seeds 3-gonous, winged.

Wild in the valleys of the Ramnagar Hills, along river beds! Cultivated in all districts. Fl. Jan.-March. Fr. April-June. Decid. Dec.-Feb. or new leaves in January.

Bark grey, corky. Young parts tomentose. Two upper petals yellow spotted, lower larger, 75" long, oblanceolate, the lateral strongly reflexed.

The leaves, flowers and fruit are eaten as vegetables, and the tree is usually pollarded for the purpose of fodder. The pungent root is used as a vesicant and has the odour and flavour of horse-radish, for which it is used as a substitute. Distilled with water the root yields a very pungent essential oil, but it is rarely used as such in Hindu medicine, either decoctions of the root or the expressed juice being preferred. The seeds yield a fine fixed oil (*Ben*) which is used by perfumers for extracting the odours of flowers and by watch-makers as a lubricant (*vide Nadkarni*).

The tree grows readily from cuttings.

FAM. 53. PAPILIONACEÆ (Leguminosæ).

Trees, shrubs or herbs with simple, 1-foliolate or compound leaves and strongly zygomorphic flowers. Calyx equally, or usually unequally lobed, often 2-lipped and usually somewhat perigynous, in a few cases developed into a distinct elongate hypanthium. Petals 5, imbricate, posterior (standard) exterior in bud, 2 lateral (wings) more or less declinate free or adhering to the keel, 2 lowest (anterior) usually more or less connate into one (keel) laterally compressed. Stamens 9 or 10 on the disc lining the very short or elongate hypanthium combined into an open or closed tube (monadelphous) or diadelphous (5+5 or 9+1), very rarely (*Sophora*) free, alternate ones

53. PAPILIONACEÆ.

sometimes different. Ovary free, usually linear, 1-carpellary with simple style and stigma, usually with 2-many ovules on the ventral* suture, rarely sub-globose with only 1 ovule. Fruit (pod) usually bifollicular and 1-celled, sometimes indehiscent and sometimes septate and sometimes breaking up into one-seeded joints. Seeds albuminous or exalbuminous.

The germination of the Papilionaceæ is variable, from hypogeal to epigeal, but usually hypogeal with, however, the first leaves *simple and opposite* and thus simulating cotyledons. The shape of these is very different, from cordate and palm-nerved as in *Canavalia* and some *Phaseolus* to linear-lanceolate and penni-nerved as in *Cajanus*.

§ Stamens monadelphous or diadelphous (1-57):—

† Stipellæ absent, ‡ Mostly herbs or undershrubs. Pod usually dehiscent (cp. †††) (1 to 25):—

- I. L. simple or digitately 3-foliolate (5-fol. in one species of *Crotalaria*). Leaflets entire, not gland-dotted (*Genisteæ*) (cp. 31. *Flemingia*):—
 - Fls. small solitary axillary. Pod compressed, 1-2 seeded 1. *Heylandia*.
 - Fls. on 2-more-flowered peduncles. Pod turgid 2. *Crotalaria*.
- II. Leaves pinnately 3-foliolate. Herbs with the sec. n. of lfts. excurrent as teeth. St. diadelphous (*Trifolieæ*).
 - a. Pod dehiscent, elongate 3. *Trigonella*.
 - b. Pod indehiscent.
 - Racemes slender. Pod sub-globose or very short. 4. *Melilotus*.
 - Racemes not slender. Pod spiral or sickle-shaped 5. *Medicago*.
- III. L. simple, pinnately 3-many-foliolate with entire leaflets (rarely toothed and then st. diadelphous). Pod not jointed (*Galegeæ*):—
 - A. Anthers apiculate. Hairs fixed by centre (very few exceptions).
 - L. 3-foliolate, leaflets toothed 6. *Cyamopsis*.
 - L. 1-several-foliolate. Lfts. entire 7. *Indigofera*.
 - B. Anthers not apiculate. Hairs basifixed.
 1. Leaves gland-dotted. Pod 1-seeded indehiscent 8. *Psoralea*.
 2. Leaves not gland-dotted. Pod several-seeded, dehiscent:—
 - a. Erect or diffuse herbs or shrubs. Pod soon dehiscent:—
 - Lfts. 5-25, usually odd. Pod flattened 9. *Tephrosia*.
 - Lfts. 20-80, often even. Pod long slender septate. 10. *Sesbania*.
 - b. Climbing shrubs. Pod often woody and tardily dehiscent 11. *Millettia*.
 - IV. Leaves even-pinnate with the rhachis ending in a tendril or bristle. Pod dehiscent, not jointed (*Vicieæ*):—
 - A. Stamens 9. Slender climbing shrubs 12. *Abrus*.
 - B. Stamens 9+1. Herbs (in our area):—
 1. Leaflets toothed. Style glabrous. Pod turgid 13. *Cicer*.
 2. Lfts. entire (exc. *Pisum*). Style usually hairy. Pod compressed (or turgid in the cultivated *Pea*):—
 - a. Staminal tube with oblique mouth:—
 - Ovules 3-many (or, if only 2, then beard annular) 14. *Vicia*.
 - Ovules only 2. Style longitudinally bearded 15. *Lens*.
 - b. Staminal tube truncate:—
 - Style broad upwards but margins not recurved 16. *Lathyrus*.
 - Style broad upwards with the margins recurved 17. *Pisum*.
 - V. Leaves odd-pinnate (exc. *Zornia*, *Arachis*, *Smithia*), rarely only 1-3-foliolate. Pod jointed (joints 1-seeded, sometimes only 1-2). (*Hedysareæ*):—
 1. Stamens 9+1:—
 - L. 3-foliolate. Ovale and joint 1 only 18. *Lespedeza*.
 - L. 1-foliolate. Spiny shrub. Joints few 19. *Alhagi*.

* The term ventral is here used in the strict botanical sense, but as the ovary is declinate the suture is uppermost, or dorsal in the ordinary sense of the word, and faces the vexillum or standard.

† Minute in some *Galegeæ*.

2. Stamens monadelphous with dimorphous anthers:—
 - L. with 1-2 prs. of leaflets. Joints 2-6 20. *Zornia*.
 - L. 3-foliate. Calyx-tube very long. Joints 1-2 21. *Stylosanthes*.
 - L. with 2 prs. of lfts. Calyx-tube very long 22. *Arachis*.
 3. Stamens 5+5:—
 - a. Joints folded inside the calyx 23. *Smithia*.
 - b. Joints several exserted:—
 - Calyx with two entire or sub-entire lips 24. *Æschynomene*.
 - Calyx teeth distinct 25. *Ormocarpum*.
- †† Stipellæ present (sometimes absent in *Cajaneæ* and then leaves gland-dotted) (26 to 53).
- VI. (*Hedysarea*, continued.) As above, but stipellæ present:—
- Stamens 9+1. (Joints inconspicuous in some *Pseudarthria* and *Desmodium*):—
1. Ovary 1-ovuled. L. 1-foliate. Raceme very lax 26. *Eleiotis*.
 2. Ovules several:—
 - a. Pod twisted up so that the joints are transverse to its AXIS 27. *Uraria*.
 - b. Pod not twisted up:—
 - i. Pod turgid, often terete 28. *Alysicarpus*.
 - ii. Pod flattened:—
 - Deciduous tree. Joints 1-5 large 29. *Ougeinia*.
 - Undershrub. Pod not septate, scarcely indented. (see *Desmodium*, sec.) *Pseudarthria*.
 - Shrubs or herbs. Pod usually septate and indented 30. *Desmodium*.
- VII. Climbers, rarely erect or sub-erect with pinnately 3-foliate (exc. *Flemingia*) leaves. Pod dehiscent, not jointed (*Phascoleæ*):—
- A. Leaves gland-dotted. Nodes of raceme not tumid (Sub-tribe *Cajaneæ*):—
1. Ovules 1-2. L. 1-3-foliate:—
 - a. Calyx not much accrescent:—
 - Erect or prostrate undershrubs. L. digitate or 1-foliate. Fls. white or red. Pod turgid (cp. *Genistee*) 31. *Flemingia*.
 - Erect. Pod compressed 32. *Eriosema*.
 - Erect or climbing. L. pinnately 3-fol. Pod turgid 33. *Rhynchosia*.
 - b. Calyx with very accrescent teeth. Climber 34. *Cylista*.
 2. Ovules 3 or more:—
 - a. Pod without channels between the seeds 35. *Dunbaria*.
 - b. Pod channelled between the seeds:—
 - Seed with a large grooved strophole 36. *Alylosia*.
 - Seed estrophiolate 37. *Cajanus*.
- B. Leaves not gland-dotted:—
1. Nodes of raceme not tumid. Style beardless (Sub-tribe *Glycineæ*):—
 - a. Stamens diadelphous. Stipules and bracts persistent:—
 - Style filiform. Calyx-teeth distinct 38. *Shuteria*.
 - Style flattened upwards. Calyx truncate 39. *Dumasia*.
 - b. Stamens monadelphous. Stipules and bracts caducous:—
 - Anthers all fertile 40. *Glycine*.
 - Alternate anthers abortive 41. *Teramnus*.
 2. Nodes of raceme tumid. Style beardless:—
 - a. Petals equal in length (Sub-tribe *Galacticeæ*):—
 - i. Herbs. Stamens diadelphous:—
 - Two upper calyx-teeth distinct 42. *Grona*.
 - Two upper calyx-teeth connate into one 43. *Galactia*.
 - ii. Stamens 1- rarely 2-adelphous. Suffruticose.
 - Upper lip of calyx projecting 44. *Canavalia*.
 - iii. Climbing shrubs. Upper lip of calyx not projecting:—
 - St. diadelphous. Pod 1-seeded (inc. *Spatholobus*). 45. *Butea*.
 - St. monadelphous. Pod linear many-seeded 46. *Pueraria*.
 - b. Petals very unequal (Sub-tribe *Erythrineæ*):—
 - Climbers. Keel exceeding wings and standard 47. *Mucuna*.
 - Trees or undershrub. Standard exceeding keel 48. *Erythrina*.
 3. Nodes of raceme usually tumid. Style bearded (Sub-tribe *Euphaseoleæ*):—

- a. Stigma oblique:—
 Keel spirally beaked 49. *Phaseolus*.
 Keel incurved. Style not flattened 50. *Vigna*.
 Keel not spiral. Style flattened upwards and circinate 51. *Pachyrhizus*.
- b. Stigma terminal, not oblique:—
 Petals equal 52. *Dolichos*.
 Petals unequal. Flowers large, blue 53. *Clitoria*.
- ††† Stipellæ rarely present. Woody plants. Pod indehiscent:—
 VIII. Leaves pinnate. Pod flattened (*Dalbergiæ*):—
 1. Leaflets alternate:—
 Flowers small, white or pink 54. *Dalbergia*.
 Flowers m.s., yellow 55. *Pterocarpus*.
 2. Leaflets opposite:—
 Pod rather thin and usually winged 56. *Derris*.
 Pod rather thick and woody, not winged 57. *Pongamia*.
- §§ Stamens free:—
 IX. Leaves odd-pinnate. Pod not jointed, moniliform. Erect shrubs (*Sophoræ*) 58. *Sophora*.

1. HEYLANDIA, DC.

A single species with simple entire sub-sessile leaves, small flowers solitary in the axils, keel of corolla beaked, stamens monadelphous, ovary sessile 2-ovuled, pod short oblong flattened 1-2-seeded.

1. *H. latebrosa*, DC.

A prostrate herb with many dichotomously-branched slender stems 8-18" long and close-set alternate spreading obliquely ovate leaves thinly villous. Flowers solitary subsessile 25" long, yellow or white with purple veins. Pod silky beaked 2-25".

Dry grassy places, not common. Fl., Fr. Sept.-Oct.

2. CROTALARIA, L.

Herbs or low shrubs or undershrubs with simple or 3-foliolate, very rarely 5-foliolate, stipulate or exstipulate, often pellucid punctate, entire leaves. Fls. racemose, sometimes also axillary, small or showy. Calyx teeth usually narrow, upper sometimes broader and connate, Corolla exserted or not, standard usually broad shortly clawed, keel petals connate into a conspicuously incurved beak. St. monadelphous, anthers dimorphous. Ovary linear, rarely only 2- usually many-ovuled; style long abruptly incurved with the keel, bearded upwards with minute oblique stigma. Pod very turgid without septa, seeds usually nearly as many as the ovules.

The distinction of terminal and leaf-opposed racemes is only relative; normally terminal racemes become leaf-opposed owing to the stronger growth of the axillary shoots.

1. Leaves simple. Mostly herbs under 3 ft. Corolla rarely (no. 6) exserted:—

A. Racemes becoming leaf-opposed (exc. sometimes 3), few-flid.

1. Stipules 0. Fls. under 6 in a raceme:—

a. Pod sub-globose. Peduncles slender 1. *biflora*.

b. Pod oblong:—

L. with long spreading hairs, base cordate 2. *trichophora*.

L. only silky, base not cordate, oblong, 7-15" 3. *prostrata*.

As in (3), but L. linear-oblong, 25-5" var. *levis*.

2. Stipules present, branches not winged:—
 - L. broadly elliptic, '15-1"'. Fls. '25"'. 4. *acicularis*.
 - L. ovate-lance. or ovate oblong, 1-2"'. Fls. '5"'. Pod glabrous 5. *ferruginea*.
 - L. ovate, 1-2'5"'. Pods hairy 6. *hirta*.
3. Stipules spreading and decurrent as large persistent wings on the branches 7. *alata*.
- B. Racemes not becoming leaf-opposed:—
 1. Racemes very short. Stipules 0:—
 - L. 2-7"'. Racemes '5-1" long. Fls. '1-12"'. 8. *pusilla*.
 - L. '5-75"'. Racemes capitate, Fls. '25"'. 9. *hirta*.
 2. Racemes 6-9-fld., elongate. Stipules foliaceous 10. *mysorensis*.
 3. Racemes elongate, usually many-fld. L. under 2" long. Stipules 0:—
 - Upper calyx-lobes connate high up. Pod not exerted 11. *linifolia*.
 - Calyx lobes nearly free. Pod much exerted 12. *albida*.
 4. Racemes elongate. L. 2-6" long. Stipules minute:—
 - Calyx '75-1"'. Fls. yellow 13. *calycina*.
 - Calyx '3-5"'. Fls. blue 14. *sessiliflora*.
- II. Leaves simple. Herbs over 4 ft. high, or undershrubs. Corolla little or much exerted:—
 - A. Bushy much branched undershrubs:—
 - L. rather broad, often rhomboid. Fls. blue and yellowish 15. *verrucosa*.
 - L. very short linear. Inflorescence glandular 16. *ramosissima*.
 - B. Tall usually strict herbs or shrubs:—
 1. Herbaceous glabrous. Corolla much exerted. Pod glabrous 17. *sericea*.
 2. Sub-woody silky. Cor. slightly exerted. Pod velvety:—
 - L. 2-4'5" linear or oblong 18. *juncea*.
 - L. 6-12" linear-lanceolate acuminate 19. *tetragona*.
- III. Leaves trifoliolate:—
 - Suffruticose 3-5 ft. Lfts. 2-3" 20. *striata*.
 - Herbaceous, often diffuse:—
 - Lfts. 1-1'3"'. Pod '5" oblong 21. *orixensis*.
 - Lfts. '2-7"'. Pod sub-globose 22. *medicaginea*.
- IV. Leaves mostly 5-foliolate:—
 - Lfts. linear-oblong or -oblancheolate 23. *quinquefolia*.

1. *C. biflora*, L.

A silky trailing herb with sometimes very numerous branches from 8-12" long from a woody root, small sessile oblique broadly ovate or sub-orbicular leaves '25-75" long, small flowers usually 2 together on long slender peduncles and comparatively large sub-globose pods.

Behar, Kurzi

2. *C. trichophora*, Baker.

A slender much branched diffuse herb covered with very long spreading slender villi, sometimes '25" long. Leaves '75-1'3" sessile with oblique sub-cordate base. Fls. very small, '15" on filiform 1-2-fld. leaf-opposed peduncles. Pods '3"'.

Bihar, rare, Kurzi

3. *C. prostrata*, Roxb. Nanha jhunka, Katie jhunka, S.

A silky herb with spreading or long trailing slender branches from a perennial root, close oblong or ovate-oblong obtuse leaves '5-1'5" long, glaucous beneath and densely silky, base oblique rounded but not cordate. Racemes on slender peduncles 2-4-fld. soon leaf-opposed attaining 3"'. Pod '5-7"', glabrous, shortly stipitate, 16-20-seeded.

CROTALARIA.]

53. PAPILIONACEÆ.

Very common on clay in open Sal forest, etc. Champaran! Chota Nagpur, all districts! Probably throughout the province. Fl., Fr. Sept.-Dec.

Stipules 0. Fls. '2-27", three lower calyx lobes linear acuminate shorter than the twisted keel, upper longer linear oblong connate half to three-fourths way up as long as standard.

Var. levis, Haines.

A small herb with numerous branches from a woody rootstock, small linear to oblong simple exstipulate strigosely-hairy leaves '25-5" long and slender terminal (leaf-opposed) racemes of 4-7 yellow flowers '22-25" long, the corolla only as long as the calyx or very slightly exserted. Pod as in type.

Neterhat 3000 ft. in open places. Fl., Fr. May-Dec.

Branches strigose. L. opaque. Petioles minute. Racemes 1-4", exceeding the branches, somewhat wavy. Bracts minute setaceous. Pedicels '1-2" slender. Calyx strigose '2", upper teeth lanceolate acute sinus '06", lower teeth rather narrower with sinus '1" deep between them. Standard very slightly exserted emarginate '18" broad with 2 small callosities at base.

Distrib. from United Provinces to the Shan Hills usually in the hills. May be distinguished from small specimens of *C. albida* in the absence of fruit by the opaque leaves.

4. C. acicularis, Ham.

A small procumbent much branched very hairy weed with a woody rootstock when old. Branches 4-10". L. broadly elliptic '15-75" scarcely petioled, base oblique rounded. Racemes 1-2", 2-several-flowered, fls. '25". Pod small black '25-3" oblong.

Open grassy places, often very conspicuous on cold mornings from the dew adhering to the hairs and giving it a grey or silvery look. Frequent. Chota Nagpur! Sambalpur! Fl., Fr. Nov.-Jan.

5. C. ferruginea, Grah.

Stems ascending 2-3 ft. branched more densely hairy, leaves oblong-ovate to oblong 1.5-1.75", stipules lanceolate, racemes pubescent lax 1-6-fl.; flowers '4-5" long, calyx with teeth as long as corolla.

Chota Nagpur, elev. 2000 ft.-3000 ft.! Fl., Fr. Sept.-Nov.

Leaves pubescent rounded both ends. Stipules conspicuous spreading '2-25". Racemes axillary and terminal, 2-5" long. Bracts '2". Bracteoles linear. Calyx 3-lipped often reddish, lower lobes oblong-lanceolate linear, standard with purplish veins. Pod '7-9" nearly glabrous, '3" broad, seeds about 25.

6. C. hirsuta, Willd.

An erect hairy herb 2-3 ft. high with broadly ovate simple leaves 2-2.3" long, very narrow stipules and terminal few-flowered racemes of yellow flowers '5" long with very long lanceolate calyx-teeth nearly as long as corolla.

Rather common in rocky jungles, Chota Nagpur! Fl., Fr. Aug.-Oct.

Hairs soft spreading. L. thin, with rounded base, mucronulate. Petiole hardly any. Stipules acicular-subulate spreading and reflexed '1-14". Racemes ultimately leaf-opposed, usually under 2". Standard spotted brown. Pod '75-1" with spreading hairs, about 6-10-seeded.

7. C. alata, Ham. Marang jhunka, S.

Stems 1-3 ft. branched sub-erect softly hairy, winged. Leaves subsessile elliptic oblong or obovate 1-2.7", usually oblique-based,



finely shortly silky beneath, scarcely punctulate. Petiole .15". Stipules decurrent. Racemes terminal and ultimately leaf-opposed. Racemes 3-4", few-flowered, with small petioled lanceo. bracts. Fls. .5-.6", calyx as long as corolla. Pod oblong 1.25-1.5" narrowed at base into a stalk, far exserted.

Frequent. Hills of Ramnagar! Chota Nagpur! Sambalpur!
Fl. Aug.-Nov. Fr. Sept.-Dec.

8. *C. pusilla*, Heyne.

A small plant 3-5" high with numerous usually spreading branches from the root and densely covered throughout with brown villous hairs. Leaves linear subsessile .25-.75". Sepals linear subulate .08" brown villous. Pod .2", the long brown hairs leaving small dots when rubbed off.

Bihar, Kura! Fl., Fr. Sept.-Jan.

9. *C. hirta*, Willd.

A herb, scarcely sub-fruticose, somewhat resembling narrow-leaved forms of *C. mysorensis* but is a smaller plant in all its parts and more diffuse. Branches densely clothed with short patent brown hairs. L. linear or linear-oblong without stipules, hairy. Fls. only 2-4 sub-capitate with lanceolate foliaceous bracts. Calyx .25" with teeth all linear acuminate. Pod oblong .5".

Not common. Behar, Kura! Savannahs, Singbhum, 2000 ft.! Fl. March.

10. *C. mysorensis*, Roth.

A rather strict herb 3-4 ft. high covered with long spreading or erecto-patent hairs. Leaves sessile linear to oblong mostly about 2" long with erect foliaceous persistent stipules .3-.6" long. Flowers sub-solitary or in few-fl. terminal racemes with lanceolate bracts .5-.6" long. Pod exserted 1-1.25" shortly stipitate in the deeply cut very hairy calyx.

Frequent in Chota Nagpur and the Santal Parganas! Fl. Aug.-Oct. Fr. Nov.-Jan.

The stipules which sometimes look like subsidiary leaves and in some Koderma plants are as large, are very characteristic. L. 2-3" pellucid-punctate. Lower sepals linear acuminate .5-.75" villous with brown hairs. Seeds 40-50 small black shining sharply hooked.

11. *C. linifolia*, L.

A herb 1-2 ft. high erect or with ascending branches, somewhat resembling the last in leaf but with black globose or oblong-ovoid pods only as long as the calyx and the marcescent corolla drying black.

Less common and more often in the open. Ranchi! Hazaribagh, Wood! Singbhum, Clarke! Fls. Sept.-Oct. Fr. Oct.-Nov.

Stems somewhat strigosely hairy. Leaves usually oblanceolate, sometimes linear but slightly wider upwards, 1-1.75", appressed silky beneath and with pellucid dashes. Racemes 3-6". Fls. .25", calyx hirsute, upper lip not deeply lobed, pod punctate, glabrous.

12. *C. albida*, Heyne.

A herb or undershrub with stems very many up to 3 ft. high from a woody rootstock, sparingly branched with fastigiate appressed-

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hairy or silky branches, narrow leaves and yellow flowers 3-5" with a very shortly exserted corolla in terminal racemes with few or up to 25 flowers.

One of the commonest forest Crotalarias, very abundant on hard clay soil on hilly ground throughout Chota Nagpur! Angul! Probably occurring in all districts. Fls., Fr. Sept.-Jan.

Stems appressed pubescent above. L. linear-oblong, oblong or oblanceolate 8-3" by 25-8" obtuse or rounded mucronate pubescent or laxly hairy above, glaucous and silky beneath, base narrowed to a very short petiole, copiously pellucid punctulate. Stipules 0 or minute subulate. Calyx very silky, two upper lobes oblong obtuse. Pod glabrous 5", slightly exserted, 6-8-seeded on pedicels 25" long.

13. *C. calycina*, Schrank. Mota bir-jhunka, S.

Herbaceous 1-3 ft. high with appressed brown-hairy branches and long lanceolate or linear leaves 3-5". Easily recognised by the pale-yellow corolla being shorter than the very large 75-1" long calyx which is shaggy with long brown hairs.

Frequent, Singbhum! Palamau! Hazaribagh! Santal P.! Probably in all districts. Fls. r.s. Fr. Oct.-Nov.

L. appressed brown-hairy beneath, very acute, closely pellucid-punctulate. Fls. axillary in the upper leaves and in terminal racemes with persistent linear-lanceolate bracts. Pod included, glabrous. Seeds pale yellow or white.

14. *C. sessiliflora*, L.

Will probably be found in Purneah as I have found it quite close to that district in Bengal. It is very like *C. calycina* but can be easily recognised by the blue corolla. Wet places. Fl. Sept.

15. *C. verrucosa*, L.

A much branched erect undershrub 3-4 ft. high with 4-ridged or -winged shortly silky branches, broadly rhomboid leaves and terminal leaf-opposed 3-7-fld. racemes 15-3" long of blue and yellowish flowers. Pod subsessile 1" thinly silky.

Mals of Orissa! Fl. March-May. Fr. April-May.

L. only 1-2" in plants seen by me, 4-6" according to F.B.I., obtuse, retuse or rounded, sometimes shallowly lobed wavy or crenate, glaucous, shortly silky both sides. Petiole short. Stipules large broad auriculate 2-4" shortly cuspidate, attached by a narrow base. Calyx 4". Standard 5" blue-veined, wings 5" long blue-veined and deep blue apically, keel pale 5". Bracts subulate 07". Seeds 12 or more.

16. *C. ramosissima*, Roxb. Harduli, Gond.

A densely branched small shrub 15-2 ft. high and as broad, stems, leaves and inflorescence densely silkily hirsute. Leaves 5-1" long linear. Flowers yellow tinged with red in very numerous few-flowered short racemes terminating all the branchlets. Pods 3" long, 1-seeded.

Quartzite rocks in open forest. Sambalpur! Fl. Oct.-Dec.

Usually grey or fulvous from the numerous hairs. L. with recurved margins, obtuse. Bracts and bracteoles ovate and with the calyx covered with a very viscid secretion which stains clothes brown and becomes a pest.

17. *C. sericea*, Retz. Sakesing, K.; Junka, Or.

A tall handsome bright green herb 3-5 ft. high with often hexagonal waxy stems, oblanceolate to obovate leaves 3-6" long with persistent stipules and long terminal often paniced racemes of



Bright yellow flowers over 1" long with persistent spreading or reflexed lanceolate or ovate acuminate foliaceous bracts 3-5". Pod glabrous 1.5".

Frequent in grass under light shade and along streams. Throughout the province, but rarely outside the forest tracts! Fls. Sept.-Feb. Fr. Dec.-May. Biennial.

L. finely appressed silky beneath, sub-acute or obtuse, petiole short and stout, stipules variable in size. Racemes 8-12". Calyx 75".

18. *C. juncea*, L. Jiri, M. (jiri-bair, the fibre); Ji, Ho.; Son, S.; San, H.; Sun Hemp.

A strict shrub 4-6 ft. high with virgate grooved stems and branches and linear or linear-oblong leaves 2-4.5" long. Flowers 1" long, yellow in lax lateral and terminal racemes 6-12" long. Beaked sepals, pedicels and pods all softly closely pubescent or velvety. Corolla slightly exserted, standard 1" broad and long, veined red, silky without. Pod 1-1.4".

Apparently wild along streams in the Northern Champaran forests! Cultivated and sometimes apparently wild in Singbhum and the Ranchi scarps! Cultivated in most districts. Fl. Aug.-Jan. Fr. Dec.-Feb.

Yields the fibre known as Sun Hemp.

19. *C. tetragona*, Roxb.

A much stouter shrub than the last with angular pubescent branches, narrowly lanceolate very acute or acuminate leaves 6-12" long and lateral and terminal racemes of large lemon-yellow flowers with glabrous slightly exserted corolla. Pod 1.5-2" stout densely brown-velvety.

Grassy ravines, N. Champaran, rare! Probably also Purneah. Fl. July-Oct. Fr. Oct.-Jan.

20. *C. striata*, DC. Sakesing, K.; Son-jhunka, S.; Junjunka, Or.

An undershrub 3-5 ft. high with slender branches, long-petioled trifoliolate leaves and terminal and lateral elongate racemes 6-12" long. Fls. yellow 75" long, usually streaked with purple. Pods 1.5-2" by .25", 30-40-seeded, silky when young and more or less glabrescent.

Waste ground and along road-sides, throughout the province, locally abundant and sometimes cultivated for its fibre. Common in Orissa and the Mahanadi delta! Annual. Fl., Fr. Oct.-April.

Lfts. 1-2.5" broadly elliptic or obovate, with sparse appressed hairs beneath, base cuneate, tip rounded. Petiole 1-2".

Possibly an introduced plant. It is now very common near Calcutta and it is curious that Roxburgh makes no mention of it. Prain distinguishes between *C. Saltiana*, And. (our species), with obtuse obovate leaflets and *C. Brownei*, Bert., with oblong acute leaflets, which latter he says is cultivated and in some places naturalised in Bengal.

21. *C. orixensis*, Roxb.

Stems several diffuse from a perennial root, lfts. elliptic or obovate, 1-1.3" long. Racemes erect very long and slender with ovate lanceolate bracts 2" and yellow flowers 25-26" on slender pedicels 3-4" long. Pods very turgid 4" long with a long stipes.

Open waste ground and borders of fields. Behar, Kura! Orissa, Prain. Fl., Fr. Aug.-Oct.

Branches and leaves beneath thinly hairy or strigose, lfts. sessile.

CROTALARIA.]

53. PAPILIONACEÆ.

22. *C. medicaginea*, Lamk.

A diffuse herb or with slender erect branches 1 foot high with 3-foliolate leaves, linear-oblong or oblanceolate leaflets 4-7" with petioles shorter than the terminal leaflet, small yellow fls. axillary and in terminal racemes and leaf-opposed racemes 1-2" long. Pod small obliquely-globose 12" diam. grooved and shortly beaked, thickly or thinly pubescent with 2 shining brown seeds.

Champaran! Palamau! Fl. r.s. Fr. Oct.-Nov.

Branches with appressed and spreading pubescence. Petioles up to 5". Lfts. rounded or emarginate at tip, silky beneath. Terminal racemes 2-15-fl. Calyx 1", upper teeth widely separate. Corolla 2" with very acute beak.

The more robust erect forms with many-fl. terminal racemes constitute the var. *luxurians* of the F.B.I., and the small prostrate forms with very few fls. the var. *herniarioides*.

23. *C. quinquefolia*, L.

An erect annual 2-4 ft. high with sulcate thinly silky branches, usually 5, rarely 3, linear or narrowly oblanceolate leaflets 2-4" long, silky beneath, and terminal racemes up to 6" long of rather large yellow flowers 5" long with linear-lanceolate reflexed bracts. Pod oblong glabrous 1.5-2" or 2.5" long and .75-1" broad, pedicelled.

Rare in our area. Bihar, in wet places! Bihar and Chota Nagpur (teste *Bengal Plants*). Fls., Fr. Nov.-Feb.

3. TRIGONELLA, L.

Herbs with pinnately 3-fol. leaves and adnate stipules. Fls. axillary or in axillary racemes, sometimes capitate, bracts minute or 0. Calyx teeth subequal. Stamens usually diadelphous or posterior filament sometimes connate to the middle, anthers uniform. Ovary many-ovuled. Pod often indehiscent, elongated, straight or falcate, sometimes beaked, not septate, many-seeded.

Erect. Fls. axillary. Pod beaked 1. *fœnum-græcum*.

Diffuse. Fls. racemose. Pod not beaked 2. *corniculata*.

1. *T. fœnum-græcum*, L. Methi, Beng, H.; Fenugreek.

An erect strong-smelling herb 1-2 ft. with thinly hairy or subglabrous stems and oblong-oblanceolate denticulate obtuse or rounded leaflets 5-1.25" long. Petiole 3-5". Fls. pale sessile 1-2 together in the axils of the young leaves. Pods at first straight, often falcate with age, 3-4" by 2" with a long fine beak.

Cultivated in the gardens of Indians! Purneah, Ham. Fl., Fr. Jan.-March.

The young plants are used as vegetables and the seeds in curries. The seeds are mucilaginous and various properties are ascribed to them; among others they are said to prevent baldness.

2. *T. corniculata*, L. Piring, Beng.

A diffuse herb with branches about 10" long, lfts. obovate 3-75" denticulate, petiole slender 25-5". Peduncles filiform 5-1" with several flowers 15-25", peduncles ending in a sharp point or awn. Pods 25-75" slightly curved, not beaked.

Rare. Bihar, Kurz! Cultivated in Tirhut, Prain.

4. MELILOTUS, Juss.

Herbs with toothed pinnately 3-foliolate leaflets and small flowers in long slender racemes. Standard and wings narrow, keel straight obtuse. St. diadelphous, anthers uniform. Ovary few-ovuled, style much incurved glabrous. Pod oblong exserted, indehiscent.

1. *M. indica*, *Alb.* Syn. *M. parviflora*, *Desf.*; *Trifolium indicum*, *L.*

A slender herb 1-1.5 ft. Lfts. obovate or oblanceolate .5" long glabrous. Fls. very small, .1" long, white in spiciform racemes 1.6-2.2" long. Pod scarcely longer than the calyx when 1-seeded, sometimes 2-seeded.

Chota Nagpur, Hazaribagh, *Clarke!* Fl., Fr. c.s.

2. *M. alba*, *Lamk.* Syn. *M. vulgaris*, *Willd.*

Herb 1-2 ft. high much more robust than the last, lfts. .1". Flowers white .2" in racemes 3-4" long or 4-6" in fruit. Pods .12".

Not uncommon in cultivated lands in the north. In fields of dhal, *Praia!* In lucern crops, *Ranchi!* Fl., Fr. Jan.-April.

5. MEDICAGO, L.

Herbs with pinnately 3-foliolate leaves and toothed leaflets. Corolla more or less exserted, standard and wings oblong, keel straight obtuse. St. diadelphous, anthers uniform. Ovary usually many-ovuled, style short, little incurved, stigma oblique. Pod usually spirally twisted, sometimes sickle-shaped or reniform with spiral tip, rarely only 1-seeded (*lupulina*).

A. Sub-erect perennials. Fls. racemose, purple. Pod unarmed.

Cultivated lucern.

1. *sativa*.

B. Diffuse annuals. Racemes very short or sub-capitate:—

Pod reniform, unarmed, 1-seeded

2. *lupulina*.

Pod spiral, maricate, 2-more-seeded

3. *denticulata*.

1. *M. sativa*, *L.* Lucern, Alfalfa.

Stems slightly hairy 1-2 ft. high, lfts. narrow oblong with cuneate base to obovate-oblanceolate .5-1.25" with sharp teeth. Racemes stout 1.5-2.5" including the peduncle. Pod silky forming a complete loop or a double spiral, venose, no intramarginal nerve parallel to the suture.

Frequently cultivated by Europeans as fodder for horses. It may be repeatedly cut before flowering. In the damper districts it is apt to be attacked by fungus in the rains and is best grown as an annual.

2. *M. lupulina*, *L.* Black Medick.

A small procumbent branched herb with pubescent branches 3-6" long. Lfts. small obovate or cuneate-obcordate, .18-.35"; young very silky beneath, toothed, the sinus usually apiculate with a small triangular tooth. Fls. very small pale yellow in dense ovoid heads, oblong in fruit, on slender hairy peduncles much exceeding the petioles. Pod very small sub-globose reniform* with tip coiled.

* *Baker (F.B.I.)* describes the pod as minute linear sickle-shaped, which is, I think, a mistake. The Black Medick is found as far west as England, and my Indian specimens, though smaller, agree with the English ones.

MEDICAGO.]

53. PAPILIONACEÆ.

1-seeded, with several strong raised concentric nerves and cross nervules, otherwise smooth, finally black.

Champaran, Bettiah, in fields! Fl., Fr. March.

3. *M. denticulata*, Willd. (sensu F.B.I.).* Toothed Medick.

A nearly glabrous herb with prostrate branches about 1 ft. long. Lfts. obovate or obcuneate, sometimes retuse at the apex, 5" long, petiole slender, 1", stipules laciniate. Flowers very few, 2-5 only, umbelled, yellow, on a peduncle much shorter than the petioles. Calyx 1", teeth as long as tube. Pod 12-2" diam. sub globose-spiral, muricate with strong nerves running parallel to margin, face reticulate, nervules meeting in intra-marginal one and with a nervule from each spine joining margin and the intra-marginal nerve.

Bihar, Kurz!

This species is also found in England, but is rare.

6. CYAMOPSIS, DC.

Erect herbs with laterally attached hairs as in *Indigofera* and pinnately 3-foliolate leaves with toothed leaflets. Stipules small. Stipellæ 0. Flowers in axillary close racemes with caducous bracts. Sepals connate into an oblique tube. Keel obtuse inappendiculate. Stamens 10 monadelphous with uniform anthers, connective apiculate. Ovary many-ovuled, stigma terminal capitate. Pod linear, subquadrate, acuminate, septate. Seeds quadrate, compressed.

1. *C. tetragonoloba*, Taub. Syn. *C. psoraloides*, DC.; Guar, H.: Buru hahar, S.; The Cluster-bean.

Rather stout 2-3 ft. high with adpressed grey hairs. Lfts. 2-3" ovate acute inciso-dentate. Racemes short-peduncled, close. Fls. pinkish 2". Pods clustered thick fleshy, 1.5-2.5" long, 8-12 seeded.

Cultivated occasionally in Santal Parganas and Manbhum!

The young pods are eaten.

7. INDIGOFERA, L. Indigo.

Herbs or shrubs more or less clothed with hairs which in most cases are forked, each fork appressed. Flowers in short or long axillary racemes, sometimes sub-capitate, usually reddish. Calyx small or minute, campanulate, teeth 5 sub-equal or lowest longest. Standard usually broad; keel straight, not beaked, each petal spurred near the base. St. diadelphous, alt. filaments sometimes longer and narrower, anthers uniform, apiculate. Ovary sessile, style short incurved, stigma capitate usually pencillate. Pod usually linear or oblong, sometimes curved, in one species muricate.

1. Leaves simple. Herbs, usually small and prostrate:—

1. Fls. clustered. Pod muricate, 1-seeded

1. *echinata*.

2. Pod unarmed:—

L. linear. Pod globose, 1-seeded

2. *linifolia*.

L. ovate cordate. Pod oblong, 2-seeded

3. *cordifolia*.

*Our species is probably var. *apiculata*, but *M. apiculata*, Willd. (= *M. denticulata*, Willd., var.) does not agree with Gaertner's figure of *M. hispida* (Gaertner de fructibus et seminibus plantarum, 1788-91) to which it has been reduced by Urban, and I have not in this matter been able to follow that authority on *Medicago*.

leaflets and narrow stipules. Fls. usually rather small, very large in *S. grandiflora*, in lax axillary racemes. Calyx teeth short sub-equal. Corolla exserted, petals long-clawed, keel petals obtuse, or in *S. grandiflora* sub-rostrate. Stamens 9 + 1 with uniform anthers. Ovary linear, stipitate, many-ovuled, style filiform, incurved, glabrous. Pod very long linear, septate, dehiscent, many-seeded.

- | | |
|---|-------------------------|
| I. Flowers very large, white or sometimes red | 1. <i>grandiflora</i> . |
| II. Flowers small or moderate-sized, under 1". | |
| A. Woody perennials without prickles | 2. <i>egyptiaca</i> . |
| B. Annual, often tall, scarcely woody, sometimes prickly. | |
| Tall. Fls. '75". Pod pendulous | 3. <i>paludosa</i> . |
| Often dwarf. Fls. '4-5" long. Pod ascending | 4. <i>aculeata</i> . |
| Diffuse. Pod erect | 5. <i>uliginosa</i> . |

The roots of the *Sesbanias* are copiously covered with large root tubercles which should make them a good green manure. The cotyledons are large epigeal, the first leaf is simple obovate or sub-three-lobed.

1. ***S. grandiflora*, Pers.** Syn. *Agati grandiflora*, Desc.; *Agati*, Vern.; Basna, H.; Buka, Beng.

A small tree attaining 25 ft. high and nearly 2 ft. girth with straight stem and spreading branches. Leaves 6-12" long with 10-20 prs. of leaflets and an odd one. Lifts. linear-oblong about 1" long. Flowers very large 3-4" long white, or in one variety red, in lax 2-4 fld. racemes. Pods long slender curved, 12-18".

Often cultivated in gardens but rarely lives more than 3 years. It grows best on black-cotton soil. Fls., Fr. chiefly c.s.

The young leaves are eaten but they are said to be aperient. The juice of the flowers is said to improve the sight when squeezed into the eyes. It is also a popular remedy for catarrh.

2. ***S. ægyptiaca*, Pers.** Jainti, Beng.

A large shrub or small straight tree attaining 15 ft. in height with pinnate leaves 4-6" long ending in a point, 12-20 pairs of close-set linear oblong leaflets '75-12" long and yellow, or variegated with orange, red and deep purple, flowers '5-7" in very lax axillary racemes. Pod twisted 6-9" slender, thin, torulose.

Gardens and waste ground. Sometimes coming up as though wild. Fls. Oct.-Dec. Fr. Nov.-Jan.

Lfts. glabrous or sparsely appressed pubescent below. Flowers 2-10. Pedicels '2-4". Standard sometimes nearly black outside, 7" broad.

It germinates readily from seed and only lives about three years giving a light shade, and may be used as a nurse to other plants, especially as it is copiously furnished with root tubercles.

The form with yellow flowers is considered the type, that with the standard dotted purple is sometimes called var. *picta* (Prain) and that with the deep purple or black standard var. *bicolor* (W. & A.).

3. ***S. paludosa*, Prain.** Syn. *S. aculeata*, var. *paludosa*, F.B.I.; Kathsola, Beng.

An erect annual 6-12 ft. high like a miniature tree, with a stout swollen tap root and lower part of stem swollen and pith-like, above green and shining. Leaves 6-12" long with 10-30 prs. of oblong slightly tapering leaflets 1" or more long, apiculate, thinly hairy beneath. Stipules caducous, semi-lanceolate. Flowers 1" yellow with standard purple-dotted. Pod linear pendulous 10-12 inches long, somewhat spiral, slightly moniliform.

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In jheels and swamps. This probably occurs in Purneah and Santal Parganas, but was included formerly under *S. aculeata* in my notes. Central Bengal, Bengal Plants. Fl., Fr. r.s.

4. *S. aculeata*, Pers. Syn. *Æschynomene spinulosa*, Roxb.; Chaipijan, K.

An erect annual somewhat resembling the last on a smaller scale, reaching 4-5 ft. in height and muricate or with small weak prickles on the branches and leaf rhachis. Leaves 6-12" long with 20-40 prs. of linear leaflets 2-6" long, obtuse apiculate, glabrous. Stipules minute, caducous. Fls. 3-5" long. Pod ascending very slender 6-9" long, beaked, straight sub-moniliform.

In wet places, common in the rains, all districts! Fl., Fr. Aug.-Oct.

5. *S. uliginosa*, Roxb.

Of this species, also, no separate record has been kept and there are no specimens from our area, although I believe I have often observed it. The stems are diffuse. Lfts. 1-2". Fls. 2", sometimes clustered. Pods sub-erect, 2.5-3.5".

11. MILLETTIA, W. & A.

Trees or shrubs, often (in our area always) climbing, with odd-pinnate leaves. Stipellæ present or not. Flowers usually showy in axillary, often fascicled racemes, or racemes paniced and terminal. Calyx campanulate, lobes short or 0. Petals with long claws, standard broad. Stamens with vexillary filament free or connate only from the middle, anthers uniform. Ovary sessile linear few-ovuled. Style filiform incurved glabrous with capitate stigma. Pod linear or oblong, dehiscent or sub-indehiscent.

The species closely resemble those of the genus *Derris* in flower. The anthers in the latter genus are however versatile and stipellæ always absent.

Standard auricled. Pod flat, very tardily dehiscent . . . 1. *auriculata*.
Standard not auricled. Pod torulose, dehiscent . . . 2. *racemosa*.

1. *M. auriculata*, Baker. Gaj, H.; Hehel, K., S.; Gurar, Kharw.; Arkawla, Or.; Gora, Ganj, Th.

A large shrub, sub-erect or climbing, with leaves 1-2 ft. long and 3-4 prs. of strongly nerved leaflets thinly silky beneath. Fls. 4-5", cream-coloured, fascicled on numerous racemes 4-9" long, which are often clustered on short stout axillary peduncles. Pod flat, but not thin, woody, tomentose, 4-6" by .75" with thickened sutures.

Throughout the whole province. In a semi-erect state often forming a dense undergrowth in many of the Sal forests in the valleys.

Fls. March-June. Fr. Jan.-March.

Innovations silky-tomentose, Lfts. obovate-oblong cuspidate 3-8" long, terminal largest, sec. n. 8-12, stipellæ minute. Racemes dense silky. Pod very late in dehiscing.

It is cut as a fodder. The root, like some other species of *Millettia*, is used to kill fish. It is also used for killing insects on cattle gyes.

2. *M. racemosa*, Benth. Gaj (confused with the last), H.; Jungi-nar, Gond.

A large climbing shrub with white bark on the branches; leaves about 1 foot long with 5-8 prs. of nearly glabrous lfts. Stipules large, filiform. Fls. cream or reddish 4-5" in copious racemes.

10-18" long with very conspicuous villous setaceous subulate bracts 3-4" long. Pods 4-8" by 3-6" linear, torulose with 2-4 tapering segments, black and readily dehiscent when ripe.

Chota Nagpur, chiefly in rocky ravines above 1500 ft., not common! Rajmehar Hills, rare! Rocky ravines in Angul, frequent! Puri, *Gamble*! Sambalpur, Jhargati forest! Fl. May-July. Fr. Jan.-March. Deciduous April.

Old bark brown and uneven. Blaze pink and pale-yellow. Shoots tomentose. Lfts. oblong-obovate sometimes wavy shortly often obtusely cuspidate, brown-silky along the mid-rib beneath, end one largest 3-4" by 1.5-2". Petiole thinly silky. Stipellæ setaceous. Petals glabrous, standard orbicular-elliptic, wings spurred. Ovary 6-ovuled.

Uses as in last.

12. ABRUS, L.

Climbing shrubs with multi-jugate deciduous leaflets and rhachis ending in a point. Fls. small or m.s. pedicelled fascicled on the swollen nodes of axillary racemes or short axillary branchlets. Calyx campanulate with very short teeth. Standard ovate short-clawed slightly adnate to the staminal tube. Stamens 9 in a slit tube (place of upper vacant). Ovary sub-sessile, ovules several. Pod flat or turgid.

Pod flat, seeds compressed. Lfts. oblong 1. *pulchellus*.
Pod turgid, seeds round. L. linear or linear-oblong 2. *precatorius*.

1. *A. pulchellus*, Wall.

A pretty climber, leaves with rhachis 3.5-5.5" and oblong leaflets 8-15 prs., 5-12" by .25-.5 or .6", apiculate, with appressed hairs beneath. Stipellæ minute subulate. Fls. pink .48" long, at first in short racemes but with the peduncle often attaining 6" in fruit. Pods often geminate at the nodes 2.5-3" long, thinly sericeous, about .44" broad. Seeds compressed ellipsoid .2" grey-black shining, in the hollows of a papery endocarp.

In the Northern Tract only. Champaran and Purneah! Fl. Aug.-Sept. Fr. Dec.-Jan.

2. *A. precatorius*, L. Kawet, S.; Karjani, K.; Karjain, Kharw.; Gunchi, rati (the seeds), H.; Sonkach, Kunch, Beng.; Runj, Gunja, Or.; Indian Liquorice; Crabs' Eyes (the seeds).

A pretty twining slender shrub with same habit as last, leaves 2-3.5" long with 10-20 prs. of leaflets 3-7", glabrous or silky beneath. Fls. usually a pale pinkish white 3" in crowded racemes 1-3" long. Pods about 1.5" long turgid. Seeds polished, usually a brilliant scarlet with a black eye but sometimes white.

Hedges and waste lands on bushes. Common in the Central and Southern tracts! Purneah! Fl. Aug.-Sept. Fr. Jan.-March or even May.

Very pretty in ripe fruit when the pods open and disclose the seeds.

These seeds contain a poisonous albuminous substance; the active principle, *abrin*, has been isolated. Powdered and the powder boiled in milk it is said to be a powerful tonic, uncooked it is purgative and emetic and in large doses gives rise to symptoms like cholera. The powdered seed is also said to be used by chamars for poisoning cattle by hypodermic introduction with a needle (sui). The root is made use of in the same way as liquorice root. The juice of fresh leaves is said to remove the spots of leucoderma. Indian medical works give several other uses.

The seeds, rati, are used by Indian jewellers as a weight; each is said to constantly weigh 1.75 grs.

53. PAPILIONACEÆ.

13. CICER, L.

Annual herbs with usually odd-pinnate leaves and toothed leaflets. Stipules sometimes coarsely toothed, conspicuous, stipellæ 0. Flowers solitary axillary. Calyx-tube oblique, teeth sub-equal lanceolate. Stamens 9 + 1. Style beardless. Pod sessile oblong turgid, usually conical at tip, style persistent. Seeds with a slender funicle.

1. **C. arietinum**, L. Bhut, S.; Chota but, Butkalai, Beng.; Chana, H.; Moraijan, K.; Chicken-pea, Bengal gram, Horse gram.

A pretty herb about 1 ft. high, much branched and viscous hairy. Leaf rhachis 1-2" long with small toothed strongly-nerved leaflets 15-3" long. Fls. bluish-purple 27-3" long on slender peduncles. Pod oblong 75-1" long, 2-seeded.

A common cold-weather crop. Fl. Jan.-Feb. It is largely eaten and horses and sheep are largely fed on it. It contains much oxalic acid. The liquid obtained from macerating the seeds is tonic and antibilious.

14. VICIA, L. Vetch.

Herbs, usually climbing by means of a twisted tendril into which the end of the leaf or leaf-rhachis is modified, rarely erect or diffuse and rhachis ending in a point. Leaves even-pinnate. Fls. often showy, sometimes very small, axillary or in axillary racemes. Calyx campanulate, often oblique, teeth unequal. Corolla exserted, wings adnate at the middle to the shorter keel and to the staminal tube. Stamens 9 + 1, mouth of sheath very oblique. Ovary 2-many-ovuled, style filiform or slightly flattened, usually pubescent or bearded. Pod compressed, continuous within.

(The genus is chiefly one of temperate climates.)

- I. Climbing or diffuse slender herbs. Rhachis ending in a tendril.
A. Flowers few, very small, 25" or less.
Lfts. 6-8 prs., pods hairy, 2-seeded 1. *hirsuta*,
Lfts. 3-6 prs., pod glabrous, 3-8-seeded 2. *tetrasperma*.
B. Flowers 75", 1-2-axillary 3. *sativa*.
II. Stout, erect. Rhachis ending in a point or tendril 4. *faba*.

1. **V. hirsuta**, Koch. The common Tare, Hairy Tare.

A graceful delicate climber with very numerous branches and slender leaves ending in branched tendrils. Lfts. alt. or opposite, usually 9-11 in our area, about 3-7" long linear or somewhat broader upwards or linear-oblong. Fls. pale blue 12" long 1-6- but usually 4-flowered at the end of a slender peduncle. Style equally pubescent all round. Pod hairy oblong or rhomboid oblong 25"-35" long, 2-seeded.

Fields, Bettiah! Champaran! Hazaribagh, Wood! Fl., Fr. Dec.-April.

2. **V. tetrasperma**, Moench. Syn. *V. gemella*, Crantz.; The Smooth Tare.

Habit similar but less graceful, leaflets usually 6-8 only, paired or not. Peduncles only 1-2-flowered. Fls. larger. Pod shortly stipitate glabrous 3-8-, usually 4-seeded.

Dinajpur district, on the edge of our area!

3. *V. sativa*, L. Ankari, Beng.; Rothi, Or.; Common Vetch.

A diffuse herb with angular stems, leaves hairy with rhachis ending in a short tendril, 4-6 prs. of obovate or oblong or linear-ligulate leaflets 5-1" long with truncate or retuse tip. Stipules semihastate often with a dark blotch, toothed or entire. Flowers 75" pale purple, solitary or paired, sub-sessile. Style bearded on the lower side near the tip. Pod linear 1.5-2" flat, 8-10-seeded. Seeds sub-globose.

Not common but fairly general, from Behar to Angul! Said to be self-sown. Fl., Fr. c.s.

It is a favourite fodder for cattle. Often cultivated outside our area. The variety with leaflets all elliptic or ovate-oblong, the lower ones shorter and broader, is only known in cultivation.

Variety *angustifolia* has leaflets of upper leaves linear-lanceolate, lower ones obovate retuse or orbiculate and more patent pods, and appears to be the form wild in temperate regions.

4. *V. faba*, L. Field Bean, also Broad or Windsor Bean.

Stem stout erect 1-2 feet high. Rhachis ending in a point or short tendril, leaflets 2-3 prs., 1.5-3" long, elliptic-lanceolate. Flowers white 1" long.

Cultivated in Bettiah, etc.! Native of Persia and the Caspian region.

15. *LENS*, Gren. & Godr.

Annual herbs differing from *Cicer* chiefly by the rhachis ending in a tendril or point, rarely with a terminal leaflet, lfts. entire, fls. sometimes shortly racemose, wings more or less adnate to the keel and to the staminal tube, the style bearded longitudinally on the inner face and by the short funicles.

1. *L. esculenta*, Moench. Cicer Lens, Roxb.; Ervum Lens, F.B.I.; Masur, Masuri dal, H., Beng.: The Lentil.

With somewhat of the habit of *Cicer arietinum*, 1-2 ft. Branches angular. Leaflets from 4-6 prs., sub-opposite, pubescent, lanceolate. The short axillary peduncle bears usually 2 small white or pale blue flowers and ends in a bristle. Pod oblong rhomboidal glabrous with two round compressed grey seeds with minute spots.

Cultivated largely in Behar, occasionally in other districts.

It is a valuable food and is said to have the property of preventing constipation.

16. *LATHYRUS*, L. Vetchling.

Scarcely differing from *Vicia* except that the staminal sheath is truncate and the style instead of being filiform is flattened upwards, always hairy beneath the stigma.

This is also chiefly a genus of the North Temperate zone.

1. *L. sativus*, L. Kansari, kesari, H.; Teora, Beng.; Chana, Or.

A very pretty little plant with winged stems. Leaves with 2 rarely 4 linear leaflets 1-2.5" long and rhachis ending in a tendril. Stipules lanceolate with a sharply lanceolate auricle, very variable in size, from 3" to nearly 1" including the auricles. Flowers solitary axillary bright blue 75". Pod dorsally 2-winged.

Sometimes cultivated as a second crop, but very general self-sown. Fl., Fr. Dec.-March.

It is largely eaten, but its continued use induces paralysis, *lathyrismus*, or hemiplegia, both in human beings and cattle. The toxic property has been traced to an alkaloid which is volatile and can be dissipated by heat. It should therefore be cooked at a high temperature.

2. *L. aphaca*, L.

An interesting little herb from the leaves being altogether reduced to tendrils at the base of which the large hastate ovate foliaceous stipules perform the function of leaflets. Fls. yellow, 1 rarely 2 axillary. Pods 1" sub-falcate, seed black, smooth, compressed.

Bihar and Chota Nagpur, but rare. In cultivated fields. A native of Europe including the British Isles.

17. *PISUM*, L. Pea.

The genus differs from *Vicia* chiefly in the truncate staminal tube and in the style, which is hard, inflexed dilated above but with margins bent back forming more or less of a channel beneath; bearded below the stigma.

1. *P. arvense*, L. Matar, H.; Batura, K.; The Field Pea.

Leaflets 2-3 prs. sharply toothed often smaller than the large auricled foliaceous stipules. Standard pale purple or white, wings and keel purple. Seeds brown, marbled or (teste Prain) grey or purple, mottled, angular.

Cultivated in Chota Nagpur!

2. *P. sativum*, L. Matar, H.; The Garden Pea.

Closely resembling the last but flowers entirely white, seeds not angled, pale yellow or green.

Roxburgh says that this is the Patna or common white field pea, and the *Choota Matar*, a small, round greenish variety of the common grey field pea. The former is cultivated extensively about Patna, and the other over every part of Bengal.

18. *LESPEDEZA*, Mich.

Shrubs or herbs with exstipellate 3-foliolate leaves. Flowers axillary or racemed. Calyx campanulate with narrow teeth. Corolla with broad standard. Stamens 9 + 1. Ovary only 1-ovuled with long slender incurved style and minute stigma. Pod of one small oblong compressed indehiscent reticulate joint.

Lfts. linear. Keel obtuse

Lfts. obovate. Keel incurved acute

1. *sericea*.

2. *macrostyla*.

1. *L. sericea*, Miq.

An undershrub with few long erect slender branches and close-set very shortly petioled leaves with linear-cuneate leaflets, in the axils of nearly all of which are abbreviated bracteolate racemes of 2-4 small white-purplish flowers 17-25" long. Pod .08-1" orbicular-oblong.

Bihar, Kurz! Neterhat, 3000 ft. Fl. r.s. Fr. Dec.-Jan.

Stems sulcate, thinly hairy. Lfts. 25-7" long with truncate or emarginate apex and a bristle in the sinus, with close ascending parallel lateral nerves, sericeous beneath. Racemes rarely elongating to one inch, bracts filiform persistent.

2. *L. macrostyla*, Baker.

A much branched shrub 3-4 ft. high with silky or densely pubescent branches clothed with short-petioled 3-foliolate leaves. Lfts. small obovate. Fls. pink 4" long in fascicles or very short racemes in the axils of the leaves or of bracts. Pod thin 25-3" long.

On the top of the Sameshwar Hills (2884 ft.). Fl., Fr. Nov.-Dec.

Shoots densely silky tomentose. L. rhachis (with petiole) 2-1" only. Stipules 1" brown nerved lanceolate or ovate acuminate. Lfts. 3-8" appressed hairy or sericeous beneath, glabrescent above, tip rounded or mostly emarginate with the strong mid-rib produced into a seta; sec. n. about 7 not clearly distinguishable from the very reticulate raised intermediate and tertiaries. Petiolules very short. Fascicles with a very short rhachis so that the fls. are really shortly racemose. Pedicels 07" elongating to 2" in fruit. Fls. opening one at a time. Calyx campanulate with teeth rather longer than the tube, lower 3 setaceous, upper combined lanceolate. Standard obovate 3" with green central spot, claw 0. Wings slightly adherent to the up-curved acute keel. Ovary densely bearded above with long hairy style which breaks above the base leaving an awn on the fruit. Pod oblong acute flattened villous, venose.

Distrib.: Himalayas, Simla and Garhwal to the Khasia Hills.

19. *ALHAGI*, Desv.

A low thorny shrub with simple leaves and small flowers in short racemes with a thorn-tipped rhachis. Calyx teeth short. Corolla exserted, standard obovate, wings free, keel incurved obtuse. Stamens 9+1. Ovary many-ovuled with filiform incurved style and capitate stigma. Pod linear, rather stout, indehiscent, septate and constricted between the seeds.

1. *A. camelorum*, Fisch. *A. maurorum*, Desv. Juwasa, H.

Thorns 2-15" long sometimes very slender. Leaves oblong mucronate obtuse drooping, 4-9" rigid glabrous. Flowers 3" red in racemes 1-15". Calyx glabrous 1". Pod 1" straight or curved, moniliform.

Dry waste ground, Gyn; Ganges banks, down to Patna, *Kew Herb.*! Near Monghyr, *Hym!* Madden!

The thorns usually are derived from one out of a pair of axillary buds and frequently develop as small branches. L. sometimes slightly hairy, in up-country specimens often only 3", base sometimes narrowed.

20. *ZORNIA*, Gmel.

Small herbs with pinnate leaves with only 1-2 pairs of leaflets more or less punctate beneath and small flowers in elongate racemes furnished with pairs of large foliaceous bracts. Calyx minute, teeth unequal, upper connate. Corolla exserted with acute incurved keel. Stamens monadelphous with dimorphous anthers. Ovary several-ovuled with filiform incurved style and minute stigma. Pod of one-several small round flattened sometimes finely muricate joints.

1. *Z. diphylla*, Pers.

A small wiry herb 6-12" with comparatively long petioled 2-foliolate leaves with lanceolate leaflets 5-1" long and minute yellow flowers sessile between and hidden by the geminate peltately attached doubly-lanceolate bracts which are 3-4" long and gland dotted like the leaves.

Chota Nagpur, open grassy places, common. Fl., Fr. r.s.
Branchlets and minute petiolules pubescent. Stipules small peltately attached deciduous. Bracts long-ciliate. Joints of pod often only one, very reticulato-venose, slightly bristly.

21. STYLOSANTHES, Sw.

Undershrubs or sub-herbaceous with pinnately 3-foliolate leaves and stipules sometimes adnate to the petiole. Flowers small in short capitate spikes. The structure of the flowers is remarkable, the calyx-tube being relatively very long and slender and there is an epicalyx of ciliated bracteoles at its base which in fruit simulate a true calyx. Calyx membranous, upper teeth more or less connate, anterior longer. Petals inserted in the throat of the calyx-tube or hypanthium, wing petals free or united at the tip. Stamens monadelphous, dimorphous, alternately with linear and very short anthers. Ovary subsessile 2-3-ovuled. Pod with 1-2 compressed rugose joints.

1. *S. mucronata*, Willd.

A procumbent herb or undershrub with a woody rootstock and spreading tough silky-villous branches 8-12' long and small leaves with leaflets 3" long. Small yellow flowers 2" wide solitary in the axils of bracts which are arranged in short capitate spikes or are axillary. Pod very small woody beaked 1- or sometimes 2-jointed and -seeded.

Sand dunes of the Orissa coast! Fl., Fr. Aug.-Sept.

Petiole and rhachis 23-3" adnate in its lower half to the connate cuspidate setose stipules. Lfts. rarely 5" slightly hairy and thinly silky, tip rounded or acute, mucronate; terminal with a minute but distinct petiolule above the rhachis, sec. n. about 4 oblique. Spikes 25-5" sessile leaf-opposed, ultimately lateral and long-peduncled or at the end of a slender branch bearing 1-2 bract-leaves. Bracts various, lower petioled and stipulate like the leaves or lanceolate and pungent or reduced to the stipules which are persistent and striate. Calyx-tube 25" long, bracteoles 13" long.

22. ARACHIS, L. Ground Nut.

Herbs with even-pinnate leaves and usually only 2 pairs of leaflets. Stipules adnate to the petiole, stipellæ 0. Fls. yellow or white in a sessile axillary capitate spike, remarkable as in *Stylosanthes* by the very long slender hypanthium. Calyx-lobes 5, the 4 upper connate, the anterior free. Petals and stamens inserted on the throat of the hypanthium, keel incurved beaked. Stamens 9 or 10, monadelphous, 5 alternate anthers shorter and dorsifixed, others longer basifixed. Ovary 2-3-ovuled, raised after flowering by the elongating torus which finally becomes stalk-like and curves down towards the ground burying the fruit. Pod indehiscent with a thick reticulate pericarp.

1. *A. hypogea*, L. Chini-badam, mat-kalai, bilaiati-mung, Vern.

A small bushy plant. The well-known Earth-nut or Ground-nut.

Cultivated in all districts and becoming an increasingly important crop. Probably native of Brazil.

23. SMITHIA, Ait.

Herbs or undershrubs with even- rarely odd-pinnate leaves and usually small leaflets, rhachis ending in a bristle when even-pinnate.

5. *A. monilifer*, DC.

A small diffuse species with branches rarely exceeding 1 ft., leaves 2-5" oblong or ell. often with cordate base, glabrous. Petiole 12-2" hairy. Pod 3-6- or rarely 8-jointed 5-7" long, globose joints minutely pubescent with curved hairs, calyx sometimes exceeding the first joint.

Hazaribagh, Clarke! Ranchi! Singbhum, common!

6. *A. vaginalis*, DC.

A diffuse or ascending variable species. Stems 6"-3 ft. with petioles relatively longer than in any of the preceding, and prominently septate pods not at all constricted at the joints 5-7" long.

Throughout Chota Nagpur, all districts, common! Behar, Kurz! Monghir, Ham. & Kurz! Puri! Probably throughout the province.

Both leaves and inflorescence variable. Prain calls all specimens with lax inflorescence "*vaginalis*" and with dense heads "*var. nummularifolius*." Baker places the distinction on the leaves, *var. nummularifolius* having small often rounded leaves. L. vary from elliptic and broadly elliptic to lanceolate, oblong or even linear-oblong 25-1'25", thinly hairy beneath, base cordate. Petioles slender up to 4", often as long as leaf. Very rarely some of the leaves are 3-foliolate (*var. heterophylla*).

7. *A. hamosus*, Edgew.

Whole plant hairy with ascending branches rarely exceeding 1 ft., leaves large 75-2" rotund or broadly elliptic. Pods compressed and often continuous within as in *Desmodium triquetrum*!

Behar!

29. OUGEINIA, Benth.

A tree with pinnately 3-foliolate stipellate leaves and rather small flowers mostly 3-nate in the axils of bracts in dense fascicled racemes from the leaf axils and the old wood. Corolla exserted, standard orbicular, wings spurred slightly adnate to the obtuse keel. Stamens 9+1. Ovary many-ovuled, style incurved, subulate, stigma capitate. Pod linear or linear-oblong of 2-5 flat, large oblong joints or joints obscure. Seeds 1-5 compressed reniform.

1. *O. dalbergioides*, Benth. Ruta, Panjan, K.; Rot, S.; Sandan, Panan, H.; Bandhan, Tinsa (Sambalpur); Pandan, Kharw.; Banjan, Or.

Usually a small and rather crooked tree in our area. Branches slender, grey. Lfts. often sub-tomentose beneath, terminal ovate, orbicular or obovate 3-6" long, obtuse, entire or crenate with 5-10 strong sec. n. Flowers often borne in great profusion, chiefly from the old wood, white or pink, on slender pedicels. Calyx campanulate with distinct teeth.

Throughout the area, from Bettiah! to Sambalpur! and Puri! Common in the hill regions. Fls. Feb.-April. Fr. May-June. Lfless. Feb.-April.

Blaze finely closely streaked with blood-red on a white ground and exuding a red juice. Large pieces are prized for the patura or hubs of the sagar wheels, and the wood is in great request for agricultural implements. The leaves are largely used for fodder. It grows best in the most southerly forests and on red clayey loams. Roxburgh says that the pillars of Madajee Scindia's palace at Oojein are made of it. Gamble gives the average weight as about 52 lb.

29a. PSEUDARTHRIA, W. & A.

An undershrub in all respects resembling a *Desmodium* except that the pod is neither jointed nor dehiscent but continuous within. Baker (*F.B.I.*, ii, 154) says that the sutures are not at all indented, but this is not correct, some pods being indented just like a *Desmodium*, so that either the species should be included in *Desmodium*, or some of the sub-genera of that genus should be retained as genera. I have adopted the former course (see *Sect. IV of Desmodium*). *Pteroloma* is a connecting link between *Pseudarthria* and *Desmodium* proper.

30. DESMODIUM, Desv.

Shrubs or herbs with pinnately 1-3-foliolate stipellate (exc. in 14 and 15) leaves and usually small flowers 1-3-nate in racemes (rarely 1-4 axillary in species of *Dicerma* and *Sagotia*). Calyx with two upper teeth often sub-connate. Corolla exserted, standard broad, wings more or less adherent to the obtuse (or acute in section *Pteroloma*) keel which is sometimes spurred. Upper stamen entirely or partially free, alternate 4 of the sheath-stamens often shorter and sometimes (section *Sagotia*) without anthers. Ovary several-, rarely only 2-3-ovuled. Style incurved, stigma capitellate. Pod usually much compressed and of one-seeded indehiscent joints with one or both sutures indented, more rarely dehiscent along one suture or rarely pod continuous within and sutures little or not indented (sections *Pteroloma* and *Pseudarthria*).

(As noted under *Pseudarthria* it appears to be inconsistent to separate off that genus from *Desmodium* and not some others of the sub-genera.)

KEY TO SECTIONS AND SPECIES.

- I. Flowers in heads or umbels. Joints of pod indehiscent. Shrubs.
 - A. *Section I. Phyllodium*. Flowers hidden by pairs of large foliaceous bracts. L. 3-foliolate 1. *pulchellum*.
 - B. *Sec. II. Dendrolobium*. Bracts minute, deciduous. Branches 3-quetrous very hairy. *Sec. n.* 10-20 2. *cephalotes*.
Branches sub-terete, young silky. *Sec. n.* 7-10 3. *congestum*.
- II. Flowers in elongate often paniced racemes. Pod indehiscent along the sutures. Erect or sub-erect (exc. No. 5).
 - A. *Sec. III. Pteroloma*. L. 1-foliolate with broadly-winged petioles. Keel acute. Pod sometimes continuous within when ripe, sutures sometimes straight.
Erect pod very hairy 4. *triquetrum*.
Prostrate. Pod sub-glabrous 5. *pseudotriquetrum*.
 - B. *Sec. IV. Pseudarthria*. L. 3-foliolate, petiole not winged. Pods continuous within and sutures usually straight 6. *viscidum*.
 - C. *Sec. V. Desmodium proper*. L. 1-3-fol. Pods with several joints (over 4), closed and indehiscent, sutures indented.
 1. Leaves 3-foliolate.
 - a. Joints of pod much longer than broad.
Bracts linear-subulate. Joints 3-4 times longer than broad 7. *laxiflorum*.
Bracts lanceolate. Joints twice longer than broad, densely hairy 8. *barbatum*.

- b. Joints scarcely longer than broad.
 Stipules large auricled. Fls. minute '1" 9. *diffusum*.
 Stipules subulate. Fls. over '2" 10. *polycarpum*.
2. Leaves 1-foliolate. Joints about as broad as long.
 Stems angled, hairs appressed. Leaves small, or
 if large, lanceolate-ovate 11. *gangeticum*.
 As in 11 but leaves large ovate var. *ramnagari*.
 Stems terete, hirsute. L. large deltoidly ovate 12. *latifolium*.
- III. Flowers small in short racemes or 1-4 axillary. Pods
 with only 1-2 joints, or, if more, separately dehiscent
 along the suture (exc. no. 15). Trailing herbs (exc.
 no. 13).
- A. Sec. VI. *Nicolsonia*. L. 1-3-foliolate. Racemes dense,
 Joints of pod 2, widely dehiscent 13. *brachystachyum*.
 B. Sec. VII. *Dicerma*. L. 3-foliolate, exstipellate. Pod
 2-jointed, indehiscent. Bracts minute 14. *biarticulatum*.
 C. Sec. VIII. *Sagotia*. L. very small 3-foliolate, stipel-
 late or not. Bracts large deciduous. Pod 2-5-
 jointed, dehiscent (exc. no. 15).
 Fls. axillary, not racemed. Pod indehiscent 15. *triflorum*.
 Fls. in very short lax racemes. Pods finally dehiscent 16. *parvifolium*.
- IV. Sec. IX. *Pleurolobium*. Shrubs or undershrubs with 3-1-
 foliolate leaves, large flowers in (often panicle)
 racemes. Pods dehiscent in a continuous line, in-
 dented but scarcely jointed.
- Undershrub, side leaflets, if present, minute 17. *gyrans*.
 Shrub. Side leaflets well developed 18. *gyroides*.

1. **D. pulchellum, Benth.** Bir kapi, S.

A shrub 3-5 ft. high with grey hairy branches, easily recognised by the inflorescence which far exceeds the leaves and bears double rows of pinnately 2-foliolate coriaceous foliaceous bracts, the rachides of which end in a filiform point, and which bear in their axils fascicles of small white or yellowish flowers '25" long.

In the forests, in all districts, sometimes almost gregarious. Fl. Sept.-Nov. Fr. Jan.-Feb.

Lfts. three, shortly grey-hairy beneath and on the nerves above, end one ell.- or ovate-oblong 3-5" long, often sinuate; sec. n. 7-10 with parallel cross tertiary. Lateral leaflets about half as large. Bracts orbicular strongly nerved. Joints of pod usually 2.

2. **D. cephalotes, Wall.** Syn. *Hedysarum cephalotes, Roxb.*; Ramdataon, Kharw.

A shrub 3-6 ft. high with distinctly 3-cornered, hairy branches, elliptic acuminate leaflets with 10-20 fine prominent silky parallel nerves and numerous yellow or reddish flowers in dense axillary short-peduncled umbels sometimes running out into racemes from reduction of the leaves. Pod silky 4-6-jointed '1-12" broad.

Rather common. N. tract, Purneah, etc. ! Chota Nagpur, in valleys, all districts ! Sambalpur ! Fl. Aug.-Oct. Fr. Nov.-Jan.

Angles of stem often shaggy. Lfts. 3-6" sometimes rather obovate, beautifully silky beneath when young, lateral half to three-fourths as long as terminal. Petiole 1-2". Umbels many-flowered with linear-oblong acute or acuminate bracts '1-12". Bracteoles linear or setaceous '12". Calyx-tube '12", anterior sepal long-acuminate '15-18". Standard '3".

Var. **congestum, Prain.** More glabrous and pods glabrescent. This may be a hybrid with the next species but is easily distinguished in our province by the numerous sec. n. and general appearance. Chota Nagpur !

40. *Desmodium*.] 53. *PAPILIONACEÆ*.

3. *D. congestum*, Wall. Syn. *Hedysarum congestum*, Rottl.; *Hedysarum umbellatum*, Roxb.

A large shrub 15-20 ft. with terete or very young obtusely 3-gonous, adpressed-silky branches, 3-foliolate leaves, and oblong or oblong-lanceolate or lanceolate acuminate leaflets 3-4.5" glabrous beneath except on principal and sec. n., which are fewer and less prominent than in *D. cephalotes*. Fls. in dense axillary short-peduncled umbels. Pods 7-1" deeply indented, joints 4-6 (mostly 5) slightly silky or glabrous.

Mals of Orissa! Fl. Sept.-Oct. (probably). Fr. Nov.-Dec.

A much larger shrub than *D. cephalotes*, branches never shaggy or acutely angled. Lifts. glabrous above, pale beneath, about 2½-3 times as long as broad, lateral about two-thirds or three-fourths as long as end one, sec. n. 6-8. Petiole 7-1". Lateral petioles .07-1". Stipules 2-2.5" lanceolate striate with a fine setaceous tip. Bracts narrow-lanceolate acuminate. Calyx-tube 15", anterior sepal with the midrib excurrent in a long filiform tip.

The differences between this species and *D. cephalotes* are well shown in Roxburgh's unpublished drawings.

4. *D. triquetrum*, DC. Syn. *Pteroloma triquetrum*, Benth.; *Hedysarum alatum*, Roxb.

An erect undershrub 3-6 ft. high with obtusely 3-angled branches, 1-foliolate leaves with an oblong rather coriaceous leaflet 2-7" long, easily recognised by its short broadly-winged petiole, small blue or purple 1-3-nate fls. in axillary and terminal lax paniced racemes 4-8" long, succeeded by linear-oblong compressed ultimately 4-7-jointed pods 7.5-1.5" long. Seeds falling out through the open end of the pod after the fall of one or more of the joints.

Purneah, in grassy jungles! Khurda (Jaimangal Forest)! and Mals of Orissa! Fl. Aug.-Sept. Fr. Dec.-March.

A very distinct species attaining 6 ft. in damp localities. Branches sometimes 4-angled, angles villous glabrescent. Leaflet acute or acuminate, base rounded or subcordate. Winged petiole 7-1.3" long by 2.5-4.5" broad, 2-cuspidate at apex. Stipules .5" erect-lanceolate. Pedicels 2-2.5". Calyx 4-cleft, upper lobe broad acute. Pod appressed hairy dehiscing transversely at each joint but lower joints usually connected by the sutures, which are only slightly indented, seeds falling out through the transverse chink or at the end of the pod. Seeds free .07" compressed white or yellow.

This section might be restored as a distinct genus or included in *Pseudarthria* which the seeds and pods exactly resemble, but the next species seems to have the normal pods of *Desmodium*.

5. *D. pseudotriquetrum*, DC. Syn. *D. triquetrum*, F.B.I. in part.

A diffuse undershrub very similar to but smaller in all its parts than *D. triquetrum*, from which its habit at once distinguishes it. Pods 2.5" broad, glabrous or puberulous on the faces, hirsute on the sutures. The joints are closed when young.

Northern Bengal, Prain; probably Purneah.

6. *D. viscidum*, DC. Syn. *Pseudarthria viscida*, W. & A.

An undershrub with slender ascending pubescent branches 2-3 ft. long, pinnately 3-foliolate leaves with rhomboid leaflets often broader than long, and slender terminal racemes of small bright red flowers .15" long on slender 2-nate pedicels. Inflorescence and small oblong

Pods more or less glandular pubescent. Pods 6-8" long pubescent and with many short hooked hairs on the straight or somewhat indented sutures, 4-6-seeded, slightly depressed between the seeds when dry and sometimes breaking across at the joints.

Puri, Khurda forests! Fl. Nov.-Dec. Fr. Dec.

Branches somewhat angled. Hairs long and straight mixed with very short and often hooked ones. L. rhachis including petiole 1'25-2" pubescent. Terminal leaflet 1-2" (2-4" in some specimens outside our area), somewhat glaucous and thinly silky beneath and thinly hairy above. Lateral leaflets about half as large. Stipules 2" linear-setaceous, striate, hairy, 2". Stipellæ very small, setaceous. Racemes sometimes paniced, pedicels 2-3-nate, 1'-2" long, reddish. Calyx 1", red, teeth acuminate.

7. *D. laxiflorum*, DC.

An undershrub 3-4 ft. high with rather thin twiggy angled branches clothed with adpressed short hairs. Leaves occasionally 1-foliolate mixed with the others. Lfts. ovate-lanceolate, elliptic or rhomboid acute, scarcely acuminate, terminal 3'5-6" by 1'5-3", lateral about half as long, adpressed hairy beneath, scabrid-puberulous above. Racemes paniced 6-12" long, lax. Fls. pretty, clustered on slender pedicels 15-37" long, the standard white, the lower lip deep purple. Pod slender 6-8-jointed, covered with minute tubercle-based hairs, scarcely constricted, joints much longer than broad, about 2 by .08".

Shady forests. Singbhum! Ranchi, Ichadag, elev. 2700 ft.! Manbhum, Campbell! Parasnath, T. Thomson! Rajmahal Hills, Kurz! Puri! Fl. Aug.-Sept. Fr. Dec.-Jan.

It is very apt to be mistaken for an *Uraria* in flower. Petiole slender pubescent 1'5-2". Stipules persistent 3" lanceolate setaceous. Sec. n. of leaflets 9-11 strong, parallel, joining a marginal one. Pedicels reflexed in fruit. Calyx white or pink, tube .05" hairy, teeth longer. Standard 2" diam., keel 2" long. In Puri the flowers are bright pink.

The elastic stamens are enclosed in the keel petals and wings, and shoot the pollen to a distance when these are depressed.

8. *D. confertum*, DC.

A shrub with thinly adpressed-hairy branches, 3-foliolate leaves with obovate terminal leaflet 2'5-3'5", remarkable for the fine raised reticulations beneath leaving only small pits between, and large flowers 4" long in curved second axillary and terminal paniced racemes. Very distinct in fruit from the densely plumose pods.

Harna River Bank, Sameswar Hills at low elevation! Fl. Nov.-Dec. Fr. Dec.-Feb.

A very distinct species in leaf, flower and fruit. Petiole about equalling the rhachis above the lateral leaflets 5-1'3". Lfts. silky beneath, obtuse, apiculate, lateral ell.-oblong about three-fourths the end one, sec. n. 4-5 oblique strong, margin thickened beneath. Racemes 3-4", rhachis pubescent. Bracts 25" lanceolate. Pedicels 2". Calyx campanulate 15-17", teeth 2 upper connate nearly to top, 3 lower lanceolate as long as tube. Standard obovate 4" by 3". Ovary densely villous 4-ovuled. Joints of pod 3"-4" long, 3-4, longer than broad, concealed by the long hairs when young.

This is essentially a Himalayan species.

9. *D. diffusum*, DC.

A stout herb much branched from the base with 2-3 ft. high, somewhat diffuse, sulcate and angled hairy stems, 3-foliolate leaves

with very large oblong auricled and cuspidate stipules and many-nerved leaflets. Flowers very minute bluish in terminal paniced racemes in the axils of 3-nate small lanceolate bracts. Pod 5-6-jointed, joints sub-circular with minute hooked hairs.

Open ground. Singbhum, *Clarke*! Hazaribagh, *Wood*! Behar, *Kurz*! Santal P. ! Fl., Fr. Sept.-Dec.

Lfts. ovate or ell.-oblong rounded both ends 2-3" long, slightly hispidulous and with sparse adpressed hairs above, thinly sericeous and pubescent beneath. Sec. n. strong parallel about 8-10. Stipellæ large, exceeding the hairy petiolules. Fls. 2-3-nate.

A noticeable species from the large stipules and persistent bracts.

10. *D. polycarpum*, DC. Baephol, *S.*; Salpani, Krishnupani, *Or.*

An undershrub with an extensively creeping rootstock sending up numerous erect or ascending stems 1-2 ft. or sometimes 3-4 ft. high. Branches hairy. L. 3-foliolate with obovate or broadly ell.-oblong leaflets usually about 2" by 1". Flowers bright purple geminate or clustered in dense or rather lax terminal often paniced racemes 1-4" long, conspicuous in bud by the closely imbricating concave lanceolate striate bracts .25" long which have a sub-aristate tip. Pods .5-8" long by .12", brown, hairy, close and erect, 5-7-jointed.

Common, often forming an undergrowth in damp rather open forests, frequent in Sal forest throughout the province! Fl. Sept.-Oct. Fr. Nov.-Dec.

Hairs on stems appressed (see var.). Lfts. membranous, or sub-coriaceous, pale and thinly silky beneath, rounded both ends or somewhat retuse, mucronulate, 1-3", side ones half to three-fourths as long as end one, sec. n. straight fine curving at the margin 5-7. Petiole as long or shorter than the side leaflets, angled, hairy. Stipules subulate setaceous .2". Inflorescence often glandular, hairy. Fls. .2-.25" on slender pedicels .15-.25" spreading or somewhat deflexed in flower, ascending or erect in fruit. Calyx .08-1", 2 upper teeth combined except at tip, 3 lower narrower acuminate, longer than tube. Joints of pod not much longer than broad, lower suture indented about one-fourth width of pod.

Var. *trichocaulon*. *D. trichocaulon*, DC.

Branches with spreading hairs. Racemes laxer 2.5-6", glandular. Fls. .25-.3". Calyx .1" reddish thinly hairy, lobes ovate longer than tube, sinus gibbous. Standard .25" broad obovate emarginate.

Hills of Chota Nagpur 3000 ft. and over, Ranchi (Ichadag)! Palamau (Adar and Neterhat)! Parasnath, *Prain*!

This plant is also said to be used medicinally in Bonai, but the different species of *Urvia* and *Desmodium* are much confused by the non-botanist.

11. *D. gangeticum*, DC. Tandi Bhidi Janetet', *S.*; Salpani, *Beng.*

Herbaceous or shrubby with somewhat angled stems, lanceolate oblong or narrowly-ovate, 1-foliolate leaves rather shortly petioled, gradually narrowed to an acute point and with rounded base, grey silky or nearly glabrous and glaucous beneath and very small flowers .12-.2" in ascending lax elongate slender axillary and terminal usually paniced racemes 6-12" long. Pod curved .5-.9", 6-8-jointed, indented about half-way down on the lower suture, upper suture slightly indented, usually with minute hooked hairs on the faces.

Throughout the whole province, common in one form or another in both forest and waste land! Fl., Fr. most of the year, but chiefly May-Jan.

Very variable, diffuse or sub-erect, depauperated specimens have leaves only .5-1.5" (var. *maculatum*, *F.B.I.*), luxuriant forest plants have stems 3-4 ft. and

leaves 3-6" long, upper surface glabrescent or somewhat scabrous or with few adpressed hairs, sec. n. 7-8 or up to 10 in the largest leaves rather strong beneath and reaching margin, often with intermediate shorter ones. Petiole '5-1" in the larger leaves, one-third to half as long as the leaves in the smaller ones. Stipules erect striate subulate with setaceous tips. Fls. purple or white, 2-several-nate, pedicels '1-15". Bracts subulate, minute or as long as pedicel. Calyx '08", teeth as long as tube lanceolate or deltoid. Pods spreading.

Var. *maculatum*, Baker. (*D. maculatum* DC.) Stem under 1 foot. Leaflet often only 1" or less, roundish or oblong with cordate base. Frequent!

Var. ramnagari, Haines.

Very robust with erect angled hairy stems and broadly ovate leaves 3-6", densely hoary-sericeous beneath. Bracts setaceous '15". Pods more erect, less curved, constrictions reaching from the lower to the straight upper suture.

Ramnagar! Fr. Dec., flower not seen. It looks at first sight very different from the type and may be specifically distinct.

D. gangeticum is regarded in Hindu medicine as febrifuge and anti-catarthal. It forms an ingredient of the compound decoction called "dasamula kvatha" which consists of ten drugs (S.M.M.).

12. D. latifolium, DC. Kursapani, Or.

An erect shrub 3-6 ft. high with densely hirsute terete branches, broadly ovate leaves of one softly-hairy membranous or coriaceous obtuse leaflet 3-6" by 1.5-3.5" with straight or cordate very broad base. Fls. purple '16-2" in numerous axillary and terminal often panicle, dense very narrow racemes 2-7" long, or panicles up to 18". Pods 3-6-jointed, joints slightly longer than broad, about '13" long, pubescent and villous.

Frequent under shade. All districts! Fl., Fr. Aug.-Jan.

This species may best be distinguished from var. *ramnagari* of the last by its spreading hairs and more deltoidly ovate leaves with a very obtuse or rounded apex. Lft. often repand, sometimes only 2" in dry places. Sec. n. 6-8 of which one is basal. Stipules lanceolate with setaceous tip. Short hairs sometimes hooked as in the last species.

13. D. brachystachyum, Grah.

A herbaceous undershrub 1-2 ft. high with thinly appressed-hairy somewhat angular stems and mostly 1-foliolate leaves with the elliptic-oblong leaflet reflexed on the petiole, 1-1.7" long, sericeous beneath and slightly so above, rounded or somewhat retuse. Fls. deep purple in axillary and terminal very short dense racemes '5-1" long with the pedicels sharply deflexed after flowering and calyces white-villous. Pod short of 1-3 joints only, widely dehiscent when ripe, and slightly hairy.

Usually under light cover in open jungles. Gaya! Singbhum, esp. Porahat! Hazaribagh, Clarke! Bonai, common undershrub, Cooper! Fl. Sept.-Oct. Fr. Dec.

Petiole '5-7". Stipules '2", stipellæ setaceous. Petiolule hairy curved, thus reflexing the leaflet which has a rounded or retuse base. Bracts ovate acuminate persistent '2" and pedicels not quite as long. Calyx teeth nearly as long as corolla, standard '12" diam. Joints of pod '1" by '06". Seed shining yellow peppered red.

14. D. biarticulatum, Benth.

A small procumbent undershrub with spreading stems about a foot long from a long woody rootstock, small digitately 3-foliolate leaves with small leaflets '2-4" long, grey silky beneath, small reddish flowers in short often branched terminal racemes and 2-jointed densely appressed-hairy pods with both sutures equally indented.

Sands of the Orissa sea-coast! Fl., Fr. Aug.-Sept.

Branches with adpressed hairs, often clothed below with the brown striate 2-fid '1" stipules. Petiole '1-12". Lifts. oblong or obovate-oblong, rounded or somewhat retuse, sec. n. 4-5 faint not reaching the margin, minutely reticulate between, petiolules very minute hairy. Stipellæ 0. Racemes '5-1-25". Bracts '05-07" subulate, striate, exceeding the short pedicels. Fls. mostly 2-nate, '2", 2-bracteolate. Calyx '1" tubular, sericeous, two upper teeth connate except at tip, 3 lower broadly lanceolate equally or slightly exceeding the tube, acute. Standard obovate. Wings and keel long-clawed. Joints of pod broadly ellipsoid '22" by 1'8."

15. *D. triflorum*, DC.

A very slender procumbent and long-trailing herb, often rooting at the nodes. Stems with fine spreading hairs. Leaves very small 3-foliolate with obovate truncate or emarginate leaflets '12-5" long with a few adpressed hairs beneath. Fls. minute, white or pink, not racemed, 1-4 together in the axils of the terminal leaves of small lateral branchlets, flowering pedicels '25-3" long. Pods curved 3-5-jointed on filiform pedicels up to '5", joints hairy or nearly glabrous reticulate-veined, rather longer than broad.

Pastures and banks, very common. Fl., Fr. Aug.-Jan. and perhaps throughout the year.

Much resembles a small *trefoil*. Stipules conspicuous persistent '1" long lanceolate. Calyx '12" clothed with long silky hairs with very long teeth. The pod in this species does not seem to open.

16. *D. parvifolium*, DC.

A prostrate copiously-branched wiry herb with small or minute 1-3-foliolate leaves and oblong orbicular or elliptic leaflets under '5" sparsely appressed-hairy beneath and with excurrent mid-rib, slender petiole with long loose villi towards apex and glandular hairy lax racemes of pale violet flowers nearly '25" long on capillary pedicels '3". St. 9+1, alternate 4 without anthers. Pod 2-4-jointed, joints dehiscent not separating.

Neterhat plateau, near streams 3000 ft. ! Fl. April-Oct. Fr. May-Nov.

Stems hairy above sometimes trailing for 2 ft. Petiole about as long as the leaflets. Stipules lanceolate brown, striate, as long as or shorter than the petiole. Leaflets dimorphous: in one form crowded and only about '1" and often orbicular, in the other up to '5" and elliptic. Stipellæ absent or most minute. Racemes very numerous, often short on small lateral shoots, '7-2" long, 2-14-fid., fls. 1-2-nate on a zigzag rhachis, buds with large imbricate deciduous boat-shaped or broadly ovate amplexicaul cuspidate bracts '12" long. Calyx '15" beaked in bud with the long-hairy linear setaceous teeth, two upper teeth connate for about one-fourth the total length of the calyx. Standard orbicular '25" broad, retuse, claw cuneate. Wings and keel shorter partly connate, keel petals spurred. Ovary thinly pilose. Ovules about 4. Joints of pod rarely 5, '12" by '1" puberulous, young glandular.

17. *D. gyrans*, DC. Gora Chand, Beng. The Telegraph Plant.

A sub-herbaceous perennial 3-4 ft. high, branches green glabrous. Leaves with an oblong or oblong-lanceolate terminal leaflet 3-4" long and 0, 1 or 2 small very narrow side leaflets '5-1" long. Fls. rather large in axillary and terminal racemes 2-6" long, the large bracts concealing the flower buds and forming a terminal club. Pod 1-1-5" shortly pubescent slightly indented, continuously dehiscent along the ventral suture.

In the damper forests and on moist banks. Champaran and Purneah, in the open! Gaya! Chota Nagpur, frequent! Probably also in other forest tracts. Fl. Aug.-Nov. Fr. Oct.-Dec.



Lfts. nearly glabrous, sometimes flushed with white, base and apex rounded, sec. n. distinct but fine, tertiaries very inconspicuous. Stipules 5" setaceous from a broad base. Terminal raceme often branched. Fls. 4-5".

The small side leaflets move by little jerks in damp warm weather.

18. *D. gyroides*, DC. Jatang sing, M.

A shrub 6-20 ft. high with softly hairy branches. Lfts. 1-3 often drooping, end one obovate rounded attaining 3.25 by 1.75", side ones rarely 1.5" long. Fls. 5" deep purple in short axillary and terminal racemes 1-2" long, with large deciduous bracts as in the last.

Along river banks and in shady ravines. Champaran! Purneah! Singbhum, especially on the Porahat plateau! Common along streams at Neterhat (Ranchi and Palamau)! Fl. Aug.-Nov. Fr. Oct.-Jan.

Lfts. appressed hairy both sides, sec. n. 6-8 and tertiaries distinct. Terminal raceme often branched rarely elongating to 4". Bracts ovate 35". Pod 1.25-2" hairy, 6-10-seeded, lower suture indented, dehiscent as in the last.

31. FLEMINGIA, Roxb.

Shrubs or undershrubs or herbs with perennial rootstocks, digitately 3-foliate or simple 1-foliate leaves, gland-dotted beneath. Fls. rather small or m.s. in minute cymes or in racemes or panicles, sometimes with large conduplicate bracts. Calyx-teeth narrow. Corolla cream or yellow or red-veined. Stamens 9 + 1. Ovary sub-sessile 2-ovuled. Pods oval very inflated, without septa, containing two rounded estrophilate seeds, funicle attached to centre of seed.

d. Leaves simple or 1-foliate.

A. Fls. in small cymes each hidden by a large conduplicate persistent bract

Leaves broadly ovate

L. lanceolate. Petiole under 3" thick 1. *chappar*.

L. lanceolate. Petiole over 3" slender 2. *bracteata*.

B. Fls. in small cymes on the rhachis of panicles with

caducous small lanceolate bracts 3. *strobilifera*.

4. *paniculata*.

II. Leaves 3-foliate. Inflorescence racemose.

A. Erect or prostrate strict shrubs with lanceolate leaflets and 6-20 sec. n. (exc. sometimes in 7).

Erect. Leaflets with 12-20 sec. n. Racemes 2-4" 5. *stricta*.

Erect. Lft. with 6-10 sec. n. Racemes 1" 6. *angustifolia*.

Prostrate. Sec. n. sometimes few 7. *prostrata*.

B. Erect branched shrubs with elliptic leaflets and under 6 sec. n.

Leaf glands evanescent. Racemes 2-5" 8. *semialata*.

Leaf glands black persistent. Racemes 1-2.5" 9. *congesta*.

C. Erect stemless. Leaflets large and broadly elliptic 10. *nana*.

III. Leaves 3-foliate. Inflorescence capitate 11. *involucrata*.

1 *F. chappar*, Ham. Ulu, K., S.; Galphuli, Kharu.; Rani dant-katta, Or.

An erect shrub 5-10 ft. high with pubescent branches, strongly-nerved orbicular-ovate cordate cuspidate leaves and axillary racemes of second 2-seriate large folded bracts enclosing the small cymes of white flowers.

Not recorded from Northern area. Central and Southern areas, frequent in the forests, often forming a dense undergrowth. Chota Nagpur, all districts! Santal Parganahs, common! Rairakhol! Athmalik! Sambalpur, rather local! Mayurbhanj! Angul! The bracts are well developed in October but it does not actually flower until Jan.-March. Fr. April-May when the bracts are brown and dry. Deciduous April and renews leaves May and June.

1. FLEMINGIA.]

53. PAPILIONACEÆ.

Leaves 2-4" each way, distinctly dotted and thinly silky in age beneath. Petioles '75-1'25" thickened both ends. Bracts '75-1" by 1'25-1'5" broad when unfolded, cordate emarginate. Fls. '3-5" opening singly in succession and then becoming visible between the parted margins of the bract, few in an umbel.

The wood is used for tooth-brushes.

2. *F. bracteata*, Wight. Syn. *F. strobilifera*, var. *bracteata*, F.B.I.

A shrub 1-3 ft. high with shaggily pubescent sharply angled branches, lanceolate or oblong-lanceolate acuminate leaves 3-7" by 1-2'5" with sub-cordate base and very short stout petioles under '3" and mostly terminal paniced racemes 2-5" long of large folded deeply cordate bracts '7-8" long which are softly hairy and (when unfolded) are over 1" broad, usually all slightly emarginate and sometimes the lowest obscurely cuspidate. Pods '3-4" thinly pubescent.

Frequent in the forests and usually in dryer places than *strobilifera*. Champaran! Chota Nagpur, all districts! Angul! Narsingpur! Kalahandi! Probably in all districts. Fl. Jan.-April. Fr. Oct.-Nov.

Leaves sometimes with very few glands beneath, base 3-nerved. Petiole usually only '2-2'5" densely pubescent. Stipules sub-persistent linear-setaceous or subulate with a filiform tip '5-1". Racemes usually with a zigzag rhachis. Fls. '25" pinkish.

Roots sometimes given for epilepsy.

3. *F. strobilifera*, R. Br.

A bushy shrub 5-8 ft. high with appressed-silky terete or slightly angular branches, lanceolate or ovate-lanc. sub-acuminate leaves 3-6" by 1-3" with rounded base and slender petioles, and numerous axillary and terminal racemes 2-3'5" long of folded membranous cordate bracts enclosing short few-flowered cymes '5" long of small white or purple flowers '25-3" long.

Frequent in shady ravines Singbhum and Porahat forests esp. at 2000 ft.! Manbhum, Ball! Palamau, Neterhat 2500 ft.! Fl. Feb.-March. Fr. Mar.-April but the conspicuous bracteate inflorescence appears in December or earlier.

L. hairy on the 10-13 strong straight sec. n. beneath. Petiole slender '5-8". Stipules very caducous, small. Bracts (unfolded) ovate cordate rounded, apiculate or shortly acuminate, usually about 1" broad and '6-9" long, puberulous. Calyx '15-2" pubescent and hairy and glandular, teeth linear-lanceolate acuminate, lowest rather longer than others 2-3 times as long as tube. Pods '3-3'2" pubescent.

Var. *nudiflora*, Haines. A very remarkable variety in which the bracts are open, or both open and folded, but caducous before the flowers expand. It is apt to be mistaken for *F. paniculata* after the bracts fall.

Saitba forest, Singbhum!

4. *F. paniculata*, Wall. Rani dantkatta, Salpini, Or.

A large shrub 4-12 ft. high with terete thinly pubescent or hairy branches, rather large ovate cordate and cuspidate membranous leaves or upper ovate-lanceolate. Stipules caducous. Fls. reddish in short rather dense axillary and terminal densely hairy panicles, bracts dry ovate to lanceolate '2-2'5" strongly nerved, caducous.

Damp Forests. Singbhum and Porahat, not uncommon! Santal P.! Angul, common in the damper forests! Sambalpur, attains 12 ft. in the Tablai-Deogaon forest! Fl. Feb.-March.

Leaves 4-6'5" long, rarely base nearly straight and oblique, glabrescent beneath except for the hairy nerves, glands inconspicuous, base 5-7-nerved, sec. n. 5-7 fine but prominent and tertiary often sub-parallel. Petiole thickened each end '75-1'5" very hairy. Fls. usually fascicled on racemes 1-3" long which are sometimes subsolitary in the axils but usually clustered and paniced, the panicles when terminal attaining rarely 6". Calyx-teeth long linear-acuminate nearly as long as the corolla which is generally pink. Pods '5", hairy.

**5. *F. stricta*, Roxb.** Also called Salpani in Orya.

A tall strict scarcely shrubby species 6-8 ft. high with large 3-foliolate leaves, lfts. lanceolate or elliptic acuminate mostly 6-11" in length with a 1-3-nerved base and 12-20 fine strong parallel sec. n. above the base. Stipules 2-3" long lanceolate caducous. Fls. purplish, veined, 25-35" long in very dense erect axillary 1-2-nate racemes 2.5-4" long conspicuous in bud by the densely imbricating brown linear-lanceolate bracts which overtop the buds and the very large basal bracts of the raceme which attain 1.2" and are often embraced by the yet longer stipules.

In the damper forests usually under dense shade. N. Champaran! Ranchi! Singhbhum! Puri! Angul, common! Narsingpur! Sambalpur (Katabaga forest)! Probably therefore throughout the whole province where the forest conditions still exist. Fl. Jan.-March. Fr. April.

Branches 3-quetrous. Lfts. hairy on the nerves beneath, lateral basal nerves never much stronger than the secondary nerves. Petiole 3-quetrous, often narrowly winged, 5-6" long. Lower calyx tooth equalling or exceeding the corolla. Pod hairy 3.5-5".

6. *F. angustifolia*, Roxb.

An erect undershrub 2-4 or 6 ft. high with tomentose obtusely 3-angled branches, 3-foliolate leaves and lanceolate leaflets 5-6.5" long. Fls. in dense axillary and sub-terminal sometimes clustered sub-spicate racemes about 1" long with sub-persistent dry villous bracts and very slender densely villous calyx lobes.

Ramnagar Forests, N. Champaran! Fl. Aug. Fr. Sept.-Dec.

Scarcely more than an erect form of *F. prostrata*, but if united with it then species nos. 8 and 9 should be united. Similar specimens were collected at Dehra Dun and North Oudh and included in *F. congesta* in the *Cal. Herb.* which it certainly is not. Roxburgh's type (not now existent) came from Hardwar, which is close to Dehra Dun.

Petioles 1-2" 4-ridged below, widely channelled above roughly 3-angled as in last. Sec. n. 6 or more reach the margin, tertiaries strong raised, hairy (hairs not appressed as in *F. congesta*).

7. *F. prostrata*, Roxb. Syn. *F. congesta* var. *semialata*, *F.B.I.* in part.

A diffuse, slightly branched undershrub with a woody rootstock, brown-tomentose angular branchlets, 3-foliolate leaves with angular not-winged petioles and narrowly lanceolate leaflets 2-4.5" long. Fls. in dense sub-spicate axillary racemes about 1" long with sub-persistent dry bracts and very slender densely villous calyx-lobes as long as or exceeding the corolla and pod.

Frequent in the forests. N. Champaran! Singhbhum! Ranchi! Manbhum, common in the rather dry forests of Gobindpur sub-division!

Fl. Aug.-Oct. Fr. Oct.-Dec.

Branches 6"-2 ft. densely tomentose when young. Lfts. brown-hairy or pubescent beneath and thinly so above, lateral basal nerves short, sec. n. (of end leaflet) 4-7 reaching the margin. Petioles 3-angled 1-2" hairy tomentose. Stipules lanceolate or subulate acuminate 2-4".

8. *F. semialata*, Roxb. Syn. *F. congesta* var. *semialata*, *F.B.I.* Bir-but, S.; Galphuli, Birja.

An erect shrub 4-6 ft. or attaining 9 ft., bushy with densely pubescent or closely villous glabrescent branches, 3-foliolate leaves with narrowly winged petiole, lfts. rhomboidly lanceolate or elliptic



53. *PAPILIONACEÆ.*

Trunk attains 9" girth in Chota Nagpur with red blaze. Young shoots densely silky. Petiole 1.5-4". Lfts. usually 4-5.5" but sometimes attain 8.5" by 4.5"! acute or acuminate, base narrowed sub-cordate. Racemes 2-5". Bracts dry .25". Calyx densely sericeous or villous, teeth 2-3 times as long as tube, lowest as long as corolla. Standard green with red stripes, wings pink, keel reddish. Pod .4" tomentose. Seeds 2 black shining, raphe basal not very large.

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53. PAPILIONACEÆ.

[33. RHYNCHOSIA.]

32. ERIOSEMA. DC.

Shrubs or herbs, usually erect with 1-3-foliolate leaves. Flowers axillary 1-2 or racemed. Calyx-teeth 5 as long as tube. Corolla exsert, standard auricled, longer than the wings and slightly beaked keel. Stamens 2-adelphous. Ovary sessile 2-ovuled, style glabrous. Pod oblong turgid 1-2-seeded. Seeds oblique, funicle attached to the extremity of the linear hilum.

1. *E. chinense*, Vogel.

An erect very sparingly branched undershrub 1.5-3 ft. high covered with long hairs. L. 1-foliolate linear, very slightly tapering, 1-3" long, silky beneath, with mid-rib and margins pilose. Stipules persistent filiform hairy .25". Flowers 1-2 axillary yellow .2" long in nearly all the leaf axils. Pod .5" clothed with long brown hairs, persistent with recurved valves after ripening.

In grassy forests, frequent in Chota Nagpur, ascending to 3000 ft. !
Fl. Aug.-Sept. Fr. Oct.-Nov.

The rootstock is said to be tuberous. The plant reminds one much of a *Crotalaria*.

33. RHYNCHOSIA, Lour.

Twining or sub-erect herbs or shrubs with pinnately 3-foliolate leaves gland-dotted beneath, with or without stipellæ. Stipules and bracts caducous. Flowers small or m.s., axillary and usually racemed. Calyx rarely somewhat accrescent (in *R. rufescens*, but never simulating a papilionaceous corolla, as in *Cylista*), tube short, teeth usually exceeding it, upper often more or less connate. Corolla included or exserted. Stamens 9+1. Ovary sub-sessile, 1-2-ovuled, style long, incurved, stigma capitate. Pod round or oblong, compressed or turgid, not or rarely septate. Funicle inserted in the centre of the seed which is reniform or sub-globose and with a small peltate, or large divided, strophiole.

A. Calyx-teeth, at least the lower, subulate or acuminate.

Suffruticose climber, lfts. rhomboid, 2-3"

Erect undershrub 2-4 ft. high, heterophyllous

Slender twiner, lfts. under 1.7". Racemes lax

Slender twiner, lfts. under 1". Racemes capitate

B. Calyx-lobes broadly oblong, corolla included

- | |
|-----------------------|
| 1. <i>bracteata</i> , |
| 2. <i>cana</i> . |
| 3. <i>minima</i> . |
| 4. <i>aurea</i> . |
| 5. <i>rufescens</i> . |

1. *R. bracteata*, Bth.

A suffruticose climber distinctly woody below, bearing a very strong resemblance to *Atylosia crassa*, with downy or grey-tomentose branches, rather large strongly-nerved leaflets, yellow flowers .5-.6" long, not paired, in very numerous often sub-panicled peduncled racemes usually longer than the leaves. Pod .75-1.3" compressed obovoid- or oblanceolate-oblong glandular-pubescent and velvety, 2-seeded (neither septate nor peltately glandular as in *Atylosia crassa*).

Angul! Fl. Feb.-March. Fr. March-April.

Branches grooved. Lfts. attain 3" by 3" rhomboid cuspidate pubescent beneath and less so above, nervation strong. Stipules lanceolate 1-1.5". Racemes often 5", with glandular pubescence,* and deciduous ovate acuminate bracts exceeding

* Baker in *F.B.I.* states that the pubescence is not glandular.

the buds which are pubescent (not varnished as in *A. crassa*). Calyx densely glandular, campanulate tube '2", lower sepal long-acuminate '25", upper two connate into a 2-toothed lip. Standard '3" diam. 2-auricled. Seeds '2" shining.

2. *R. cana*, DC.

A sub-herbaceous undershrub erect about 4 ft. high villous and glandular-hairy, leaflets of two kinds, rhomboid obovate or oblong 1-2.5", and small lanceolate-acuminate or linear. Fls. small yellow or reddish '3" (tip of standard to tip of keel) on 1-2-fld. short axillary peduncles, corolla twice as long as calyx. Pod '4-5" oblong somewhat flattened neither septate nor lineate, sometimes slightly depressed between the seeds, minutely puberulous glabrescent.

Durgapur range, Angul, on sandstone, frequent! Gyra, Thoms. and Anders. ! Fl., Fr. Dec.-March.

Very variable, the broad large-leaved form and the small linear-leaved form would be taken for different species but occasionally plants occur with both kinds of leaflets. Very glandular with stalked glands above, but the gland-hairs tend to disappear in some plants. Branches often whippy at the ends. Petiole '3-1". Lateral leaflets smaller than end one which is often 3 times as long as broad more or less hairy beneath, with stalked glands in small form. Peduncles '1-75". Pedicels '1". Calyx 2-lipped, upper 2-lobed, lower with 3 subulate hairy teeth about twice as long as tube. Standard longer than wings and keel yellow streaked with red. Seed resembling that of *R. rufescens* and with a large divided strophiole.

3. *R. minima*, DC.

A very slender trailing or twining herb with angled puberulous stems, leaflets orbicular- or ovate-rhomboid mostly under 2" long. Racemes laxly 3-8-fld. Fls. yellow '3" long, calyx minutely silky, teeth subulate-acuminate, corolla about twice as long as the upper teeth. Pod '5-7" long, flattened, oblong-oblongeolate, slightly curved, pubescent (glabrescent, F.B.I.). Seeds brown mottled black, '12-14" long.

Open jungles. Rajmehal Hills, Kurz! Koderma, Palamau, frequent! Fl. Sept. Fr. Nov.

Var. *laxiflora*, Baker.

Our specimens all belong to this variety which has ovate-lanceolate leaflets with deltoid base and are 1-2" rarely 2.5" long, the type being rounded at apex and rarely attaining 1". They are not however glabrous (as described in F.B.I.) but minutely hispidulous. Stipules linear-lanceolate persistent. Racemes very lax, attaining 5.5". Strophiole minute, peltate.

4. *Rhynchosia aurea*, D.C. Var. *capitata* is a small species only once recorded by Kurz from Behar. It is a slender twiner with small broadly rhomboid leaflets about '7-1" each way, very easily recognised by its flowers being aggregated in capitate racemes and by its square or orbicular membranous villous pods '35-4" diam. closely striate with transverse raised lines.

5. *R. rufescens*, DC.

A scarcely woody rusty-pubescent often glandular-hairy climber with slender whip-like branches, rhomboid or ovate scarcely acuminate leaflets 1-2.5" and very numerous lax few-flowered racemes of smallish yellow flowers, the corolla included in the large deeply 5-fld calyx which has broadly oblong segments '3" in flower attaining '5" in fruit. Pod beaked sub-quadrate oblong. Seed 1 subglobose mottled, with a large grooved strophiole.



Forests. Singbhum! Koderma, Hazaribagh, among rocks, frequent! Haripur forest, Puri! Durgapur Range, Angul! Fl., Fr. Dec.-March.

Stems sometimes woody below, gland-pubescent above. Leaflets sub-equal much reduced in size on the upper branches, terminal usually rhomboid-lanceolate, both sides pubescent, base 3-nerved, sec. n. 2-3, looped and with raised reticulations, glands very minute. Petiole 1-3". Racemes 1.5-3" long, laxly 3-5-fld. Standard sub-orbicular .32" broad with 2 small inflexed auricles above the claw, wings spurred oblanceolate. Ovary silky 1-ovuled, slender style swollen in middle.

34. CYLISTA, Ait.

A twining shrub closely allied to *Rhynchosia*. Fls. in axillary sometimes paniced racemes with lanceolate acuminate caducous bracts, differing from *Rhynchosia* in the excessive development of the persistent calyx, the lobes of which are at first sub-petaloid both in form and texture but become scarious. Anterior sepal boat-shaped, largest resembling the keel petals of a corolla, enlarging to 1 inch or more in fruit, upper two connate in an emarginate lip and the lateral shortest very obtuse. Ovary 1-3-ovuled* and pod small oblong keeled somewhat oblique, glandular, enclosed in the calyx. Seed not or very slightly strophiolate.

1. *C. scariosa*, Ait.

A somewhat extensive but scarcely woody climber with densely pubescent stems and petioles. Lfts. softly shortly hairy above pubescent beneath especially on the nerves, terminal rhomboid about 5.5" by 4.5" acuminate, base rounded on the petiolule. Fls. in very numerous sometimes branched racemes, yellowish and red. Calyx .5" and enlarging to over 1", two posterior sepals resembling the standard of a corolla, the true corolla concealed within the calyx.

Angul, in the forests, especially climbing over undergrowth near open ravines! Athmalik! Fl. Nov., also Feb.-March (perhaps Nov.-March?).

Lfts. microscopically gland-dotted beneath, dull and rugose above; primary nerves 3, sec. n. about 4 on each side of mid-rib, tertiaries strong transverse and reticulate, lateral leaflets ovate, much broader below mid-rib, acuminate, larger about 4.5 by 3". Stipellæ small setaceous or acicular, .2-.25". Pod .4" pubescent and glandular.

The Angul plant differs rather from type in the leaflets being glabrescent between the nervules and in the more slender racemes which attain 6" in length.

Dunbaria circinalis, Baker, was found in the Jalpaiguri district, not in our area. The genus has been included by mistake in the Key.

36. ATYLOSIA, W. & A.

Erect or twining herbs or shrubs with pinnately or sub-digitately 3-foliolate leaves gland-dotted beneath, often exstipellate. Fls. small or m.s., axillary or racemed. Calyx-teeth distinct. Keel of corolla not beaked. Stamens 9+1. Ovary sessile with terete incurved glabrous or pubescent but not bearded style, and simple or capitate stigma. Pod linear or oblong, somewhat flattened, thick septate and with depressed lines between the seeds which have a conspicuous divided strophiole.

- | | |
|---|---------------------------|
| A. Erect shrub 3-6 ft. high. Pod minutely velvety | 1. <i>cajanifolia</i> . |
| B. Twiners or suberect with twining branches. | |
| Suffruticose. Lfts. 2-4". Fls. 7" | 2. <i>crassa</i> . |
| Herbaceous. Lfts. ovate 1-2". Fls. 5-6" | 3. <i>platycarpa</i> . |
| Herbaceous. Lfts. ell.-oblong .5-1.5". Fls. 3" | 4. <i>scarabaeoides</i> . |

* Wrongly described as 1-ovuled in all works consulted.

1. *A. cajanifolia*, Haines (Jour. As. Soc. xv, 7). Ban Arhar, Or.

An erect shrub 3-6 ft. very like *Cajanus indicus* in general appearance. Stems minutely pubescent angled by three decurrent lines from the nodes. Lfts. sub-digitate rhomboidly lanceolate very acute 3-nerved, lower 1.5-3", uppermost often only .5". Fls. dull yellow about .5" long, 1-4 usually 2 on short or long axillary peduncles longer than the leaves. Pod 1-1.3 by .4" deeply grooved 4-6-seeded, minutely velvety.

Forests of Southern range, Puri! Fl. Nov.-Dec. Fr. March-April. Sub-deciduous in the hot season.

Petiole .5-1.5". Lfts. pale, minutely pubescent, or sub-tomentose beneath, very acute, exstipellate, margin thickened, sec. n. about 4, tertiaries reticulate. Peduncles .8-1.8" long. Pedicels .3" long. Calyx .15-.19", teeth triangular. Corolla .42-.45". Standard purple brown veined at the back, corolla sometimes marcescent. Seeds .17" black shining with large strophiole.

2. *A. crassa*, Prain. Bir rambara, K.; Bir malhan, S.

A suffruticose climber with downy or tawny-tomentose stems, rather large strongly-nerved leaflets, yellow marcescent flowers .7" long in pedicelled pairs on short axillary and paniced racemes. Pod 1-1.8" by .4-.6" with strong oblique furrows. Seeds 3-6.

Bettiah Forests, Champaran! Central tract, not unfrequent in the damper valleys; Porahat! Palamau! Manbhum! Ranchi ghats! Southern tract: Singbhum! Angul (Labangi)! Puri (Kahuri)! Fl. Jan.-March. Fr. March-April.

Branches grooved. Lfts. attain 4" by 3.75", terminal usually rhomboid, rugose above, yellow- or brown-pubescent, sec. n. 2-3 above the 3-5-nerved base and with strong cross nervules. Petiole 1-4". Racemes 1-4" usually paniced with large deciduous concave oblong paralld-nerved bracts .5-.75" long. Calyx .3", lobes 1-1.5 as long as tube, upper two combined into one obtuse or emarginate. Standard and wings auricled. Ovary yellow-glandular, margins pubescent. Seeds .25". Strophiole large.

3. *A. platycarpa*, Bth.

A slender annual twiner with hairy stems, broadly ovate acute or acuminate leaflets 1-1.5 rarely 2" long, fls. .5-.6" long subsolitary on axillary slender peduncles, pods oblong 1.2-1.5" by .5-.6" compressed 4-5-seeded lineate not deeply furrowed, with deciduous spreading hairs.

Rare. On rocks in the Horhap Forest, Ranchi! Behar, Kurz! Fl. Aug. Fr. Oct.-Nov.

Rhachis of end leaflet about .5". Lfts. hairy with 3 slender basal nerves. Peduncles 1-2-fld. .5-1.3". Calyx narrow .4-.5" with long setaceous teeth, very hairy.

4. *A. scarabæoides*, Benth. Gaisani, K.; Bir horec', S.; Ban Kulthia, Or.

A copiously branched pubescent grey-green herb with flexuose ends to the branches or more usually with slender twining branches, small strongly-nerved leaflets, terminal elliptic- or obovate-oblong .5-1.5" or usually only 1" long, smallish yellow or reddish flowers .3" long, the corolla not much exceeding the densely grey-silky calyx. Pods small oblong very hairy or silky .75-1" long, about 5-seeded.

Very common in somewhat open forest on clay soils, throughout the Central and Southern areas! I have not noted it from the Northern area but it probably occurs. Fl. Aug.-Dec. Fr. Oct.-April.



Stems pubescent. Lfts. with 3 primary nerves tomentose when young; the glands in some specimens almost evanescent: lateral somewhat smaller and somewhat oblique. Petiole usually shorter than the terminal leaflet which has a rounded apex. Stipels 0. Peduncles '25-75" slender 1- few-flowered. Seeds under '2", grey-brown, oblong rounded.

The seeds are eaten but chiefly by children. Campbell says that the plant is given for diarrhœa in cattle.

37. CAJANUS, DC.

An erect shrub with m.s. racemed flowers. The genus differs from *Atylosia* in the non-strophiolate seeds. The ovary is sub-sessile and the depressions between the seeds oblique.

1. *C. indicus*, Spreng. Arhi, Arhar, *K., H.*; Pigeon Pea, Dal.

An erect shrub 4-8 ft. high with slender grey-silky grooved branches, hairy oblong-lanceolate leaflets 1.5-2.5" long whitish beneath and yellow flowers '75" long in axillary racemes and terminal panicles. Filaments alternately longer and shorter. Pod 2-3" long, silky, often with dark purple spots. Seeds 3-4 globose and the size of a small pea, pale brown.

Cultivated throughout the province, often on a large scale. Fl. r.s. Fr. c.s. but depending on the time of sowing. Perennial but usually grown as an annual.

Probably a native of Africa.

The dal is highly esteemed and said to be easily digested but it is regarded as heating and apt to produce costiveness. The tender leaves are chewed in cases of aphthæ and spongy gums (*Nadkarni*). Lac has sometimes been grown upon it.

The first pair of leaves are opposite lanceolate gland-dotted beneath and stipulate. They are apt to be mistaken for cotyledons.

38. SHUTERIA, W. & A.

Climbers with 3-foliolate stipellate leaves and conspicuous persistent bracts and bracteoles. Fls. small or m.s., racemose. Calyx tube gibbous, teeth shorter. Standard not spurred, exceeding the spurred wings and united keel petals. Stamens 9+1. Ovary sub-sessile or stipitate, many-ovuled, style incurved filiform, beardless. Pod flat linear usually recurved.

1. *S. densiflora*, Benth.

A slender twiner with pubescent stems, very slender petioles membranous nearly glabrous ovate or rhomboid leaflets mostly 1-2.5" long with very rounded or emarginate apex and small white and purple flowers in dense axillary fascicled racemes with brown striate bracts clothing the rhachis. Pod at first strap-shaped thin 1-1.2" long, finally dehiscent with spirally wound valves brown glabrous, 6-8-seeded.

Singbhum, in the damper valleys, rare! Ranchi and Palamau, in valleys at about 3000 ft.! Fl. Dec.-Feb. Fr. Feb.-April.

Leaflets rather pale beneath, and one attaining 3" by 2", apiculate, base rhomboid, "sec. n. very fine, rhachis very slender, stipellæ small setaceous. Racemes '75-1.75" long sessile with hairy rhachis, pedicels mostly geminate '12", bracteoles lanceolate as long as calyx, '12-2" long. Standard '3".

39. DUMASIA, DC.

Slender climbers with the habit of *Shuteria* but bracts and stipules small and inconspicuous. Calyx-tube cylindrical with oblique sub-truncate mouth, base gibbous. Petals sub-equal, standard spurred.

Wings and keel adherent with small limb and long claws. Ovary linear sub-stipitate, few-ovuled, style flattened upwards. Pod linear falcate, torulose.

1. *D. villosa*, DC.

A very slender twiner with thinly hairy stems. Lfts. membranous broadly ovate-oblong, terminal with sub-rhomboid or triangular base and rounded or obtuse apex. Flowers pale yellow '6" long in very slender racemes 1.5-3" long, standard reflexed and deeply emarginate spurred above the long cuneate claw. Ovary sericeous, ovules 3-4. Pod 1-1.5" long velvety or sub-glabrous.

Chota Nagpur. Ravines near Neterhat, elev. 3000 ft.! Parasnath! Fl. Oct.

Lfts. pale glaucous beneath and with short appressed hairs in our specimens var. *leiocarpa*, 1.5-2.5", terminal larger than lateral, lateral with rounded or truncate base, all apiculate, rhachis slender, 1.5-2.2" above the thickened petiole and '5" between the leaflets. Stipules erect linear-setaceous '1", stipellæ minute. Bracts and bracteoles minute. Calyx '3-3.5" long. Pod in type velvety, in var. *leiocarpa* nearly glabrous. The type has not been found in our area.

40. GLYCINE, L.

Twining or sub-erect herbs with 3-7-foliolate stipellate leaves and blue or red flowers in axillary racemes. Corolla little-exserted, petals sub-equal, standard not distinctly spurred. Stamens monadelphous. Ovary many-ovuled, style short beardless. Pod linear or oblong, flat or rather turgid, few-seeded.

1. *G. hispida*, Maxim. Syn. *Glycine Soja*, F.B.I.; *Dolichos Soja*, Roxb.; *Ram kurthi*, H.; *Gari kalai*, Beng.; *Hende disum horec'*, S.; The Soy Bean.

Suberect or trailing about 1-2 ft. high looking like a *Phaseolus* with very hirsute stems, petioles and inflorescence. Lfts. ovate or oblong-lanceolate or lanceolate about 3" long, more or less hairy both sides, petiole very long, often 5-6". Fls. '2" pale blue (or reddish, F.B.I.), in sessile very short and hirsute racemes not exceeding 1.5", pedicels very short, calyx about '15" densely hairy. Pods oblong narrowed at the base, 1-1.5" long, straight or slightly curved, hairy. Seeds 2 (-3) deep brown or black compressed ellipsoid '35-38" long with hilum '1" long.

Occasionally cultivated, Purneah and S.P.! Manbhum. Fr. Oct., May.

41. TERAMNUS, Sw.

Slender twiners with 3-foliolate minutely stipellate leaves. Fls. in very slender racemes, corolla little exserted, petals subequal, standard not spurred. Stamens monadelphous or diadelphous with the 4 alternate anthers small or abortive. Pod linear with a short upcurved beak (persistent style), seeds several.

1. *T. labialis*, Spreng.

A very slender twiner with glabrescent branches. Lfts. very variable in size, sometimes only '6-1.3", at others 1-3" long, elliptic or ovate or terminal somewhat obovate, thinly appressed-hairy beneath, sec. n. 3-4, petiole shorter than or equalling the terminal



leaflet. Racemes very slender 1.5-5" with distant clustered or solitary flowers in the axils of small subulate bracts. Fls. about 2" long, calyx densely covered with adpressed white or tawny hairs, corolla pink purple or white. Ovary hispid. Pod narrow linear straight or slightly curved 1.5-2.2" long thinly appressed hairy. Seeds red when fresh, black when dry, oblong, .12" long, about 10.

Widely distributed. Bihar, *J.D.H.*! Shahabad plains, *J.D.H.*! Gya, *Clarke*! Palamau! Manbhum! Monghyr, *Madden*. Fl. July-Sept. Fr. Oct.-Dec.

42. GRONA, Lour.

Twining herbs with stipellate, sometimes very narrow, 1-foliolate leaves and deciduous bracts and stipules. Fls. racemed, nodes of raceme slightly swollen. Calyx campanulate with narrow teeth, two upper shorter but not connate. Petals exserted, nearly equally long, standard and wings spurred. Stamens 9+1, anthers uniform. Style beardless. Pod linear compressed or turgid, septate.

1. *G. Grahmi*, Benth.

A slender twiner with linear or lanceolate-oblong leaves attaining 7.5" in length. Flowers reddish in distant pairs rarely some solitary, mostly geminate in short racemes. Pod compressed 2-2.3" long densely hairy; seeds with a small strophiole, orbicular.

Ranchi, Biru, *Rev. Cardew*! Manbhum, *Campbell*! Bonai, frequent! Fl. Aug. Fr. Sept.

Leaflet hispid on the thickened marginal nerve and with deciduous hispid hairs beneath finally glabrescent and glaucous, sec. n. very numerous and nervules reticulate; petiole .5-.7" long, hairy, stipellae acicular. Fls. .4" long, racemes usually one to three together, 1-3" long. Lower calyx teeth much exceeding the tube, linear.

43. GALACTIA, P. Br.

Slender twiners with 3-foliolate stipellate leaves. Flowers racemed with the nodes of the raceme somewhat tumid. Calyx teeth linear or lanceolate, the two upper entirely connate into one. Corolla little exserted. St. 9+1. Style beardless. Pod linear flattened, sometimes curved, sub-septate. Seeds without strophiole.

1. *G. tenuiflora*, W. & A.

A slender climber with small elliptic leaflets .4-1.5" long, shortly silky and finely reticulate beneath. Fls. .3" in very few-fl. elongate and very slender racemes. Pods curved 1.2-1.5" flat sericeous, seeds about 8.

Behar, *Kurz*! The only record.

Kurz's specimen belongs to variety *villosa* of Baker (*F.B.I.*) = *Galactia villosa*, W. & A., which is distinguished by the leaflets being densely villous beneath and larger (attaining 3.5" according to the *Madras Flora*), mucronate, sec. n. 7-8.

44. CANAVALIA, DC.

Large suffruticose twiners or prostrate herbs with stipellate 3-foliolate leaves and rather large flowers in racemes with tumid nodes. Calyx 2-lipped, upper lip entire or with 2 rounded lobes, lower 3-toothed. Standard larger or shorter than the wings and incurved obtuse keel. Stamens monadelphous, or posterior free at

base. Ovary many-ovuled, style beardless. Pod large linear or linear-oblong, somewhat compressed with the upper suture strongly 2-ribbed. Seeds large sub-compressed with linear hilum, enclosed in a thin papery endocarp.

On germination the large oblong fleshy cotyledons are somewhat epigeal, the first leaves are simple, opposite, deeply cordate and palminerved, with erect oblong interpetiolar stipules.

- | | |
|--|------------------------|
| I. Lfts. ovate or oval, very few obovate, glabrous or nearly so. | |
| Lfts. ovate acute or acuminate with obtusely cuneate base. | |
| Seeds 1", pink or red, compressed. | 1. <i>ensiformis</i> . |
| Lfts. oval or broadly-ovate, often obtuse, base rounded. | |
| Seeds 7", scarcely compressed, brown | 2. <i>virosa</i> . |
| II. Lfts. orbicular-obovate, rounded or retuse, often with white silky hairs | 3. <i>lineata</i> . |

1. *C. ensiformis*, DC. Syn. *Dolichos ensiformis*, L.; *Canavalia gladiata*, DC.; Tihon, K., S.; Makhan Sim, Beng.; The Sword Bean.

A climbing perennial with green glabrous stems, terminal leaflet 4-6" long glabrous ovate usually shortly acuminate and with obtusely cuneate not rounded base. Fls. large white or pink. Calyx glabrous 5-6" long, standard broadly oblong 1-3" long and 1-4" broad, wings 1-4", long-clawed, slightly adnate to keel. Ovary slender silky below, swollen below the style. Ovules 10 or more. Pod usually 8-10" long by 1-3" broad. Seeds bright rose-pink 8-9" long, rather strongly compressed.

Apparently wild along river valleys in the Angul jungles and cultivated in all districts! Fl. Aug.-Dec. Seed ripens March-April.

In cultivation the plant is somewhat variable, but chiefly in the length of the pod and number of the seeds; the measurements above given are chiefly those of the wild or feral Angul plant, the pod of which has a distinct curvature (in opposite direction) each end. The seed is always pink when ripe, though *Roxburgh* refers to a grey variety in Silhet.

The seed and the sliced fruit are eaten.

The plant is usually grown as an annual, as the natives say that the subsequent crops of seed are more or less poisonous! This is interesting in view of the next species being reputed poisonous. The seed germinates in June. The interpetiolar stipules of the first leaves are 6" long, oblong, sometimes 2-fid. The regular stipules are mere points.

2. *C. virosa*, W. & A. Syn. *C. ensiformis* var. *virosa*, F.B.I.; *Dolichos virosus*, Roxb.; Kath-sim, Kala-sim, Beng.; Mohrhorha, Bahara, Or.

A climbing perennial with usually reddish and tougher stems than in the last. Terminal leaflet 1-5-4" long rarely 5-5", broadly elliptic-oblong or broadly-ovate with a rounded tip and short cusp or obtuse, rarely acute or sub-acuminate, base rounded; usually with few scattered hispid hairs beneath and petiolules hairy. Flowers lilac-purple 1-2" long usually reflexed in shorter but closer-flowered raceme than the last, calyx puberulous 5-5", standard sometimes 1-2" broad not as long, with two strong calli above the claw. Wings 1-4" adnate to keel at base, wavy. Ovary silky tapering into the style. Ovules about 10. Pod attaining 7" by 1-5" but often much smaller (4-5") nearly straight, brownish when ripe. Seeds 4-8 ellipsoid or somewhat ovoid 6-7" long and much less compressed than in *ensiformis*, marbled with light and darker brown, hilum 5" long.



In hedges and scrub forest, especially near the sides of ravines, common in the Southern Area but not elsewhere. Purneah! Puri! Angul! Fl. Aug.-Dec. Fr. ripens March and newly germinated seedlings may be found in April. These are very hairy.

The interpetiolar stipules of the first leaves are oblanceolate, 4-5" long.

The character of obovate leaflets so often given to distinguish this species from the last is quite useless; it very rarely has obovate leaflets. The very distinct seeds on the other hand have not been usually noticed. In the forest the very frequently red stems and venation at once distinguish it.

The seeds are reputed poisonous, but the young pods are sometimes eaten.

3. *C. lineata*, DC. Syn. *C. obtusifolia*, F.B.I.

A prostrate plant with long stems several feet long (but not climbing) which at least when quite young are clothed with white silky hairs. Lfts. silky when very young, glabrescent, orbicular-obovate or orbicular, rounded or retuse, terminal 2-4" long and broad. Fls. pink much as in *virosa* but in fewer fld. racemes which exceed the leaves. Pod straight 3-4" long by 1" broad, 4-6-seeded.

Sandy sea-shores from Balasore southwards! Fl. Oct.-Nov. Apparently dying down after fruiting in March. New shoots in May.

The stipules are somewhat better developed in this species, broadly ovate but very small.

The plant roots at the nodes and tends to bind the sand.

45. BUTEA, Roxb.

Trees, sub-erect shrubs or large woody climbers with pinnately 3-foliolate stipellate leaves. Flowers large or rather small fascicled on the tumid nodes of racemes or panicles. Calyx campanulate, teeth short or lanceolate. Petals sub-equal or unequal, keel incurved and acute or straight and obtuse. Stamens 9+1. Ovary 2-ovuled, style beardless. Pod much compressed oblong, the base sometimes sub-samaroid and the apex dehiscing round the terminal seed, sometimes seed more central and pod sub-indehiscant.

- | | |
|---|------------------------|
| A. Flowers very large, red. Keel incurved, acute. | |
| Tree. Lower calyx-teeth deltoid | 1. <i>frondosa</i> . |
| Large climber. Lower calyx-teeth lanceolate | 2. <i>superba</i> . |
| B. Flowers not very large, keel little-curved, sub-obtuse. | |
| Sub-erect shrub | 3. <i>minor</i> . |
| C. Flowers rather small, cream-coloured. Keel straight, obtuse. | |
| Large woody climber | 4. <i>parviflora</i> . |

1. *B. frondosa*, Roxb. Morud, K.; Murup', S.; Dhak, H.; Paras, Palas, Beng.; Porasu, Polas, Or.

A small or m.s. tree with usually crooked trunk and black nodose branchlets. Leaves rarely 1-foliolate. Lfts. coriaceous 4-8" long and broad, with a markedly greyish appearance when seen from a distance, grey tomentose or pubescent beneath, shining above, terminal obovate rounded at apex, or emarginate lateral oblique and considerably smaller. Flowers scarlet and orange 1.5-2" long, borne in great profusion on the usually leafless branches. Calyx velvety black, campanulate, coriaceous, upper lip sub-emarginate, lower with three deltoid teeth. Pod about 6" long, velvety brown. Seed oval compressed brown, 1.5" long.

Very common in the Central and Southern areas exc. Puri, and often gregarious in cultivated and waste lands esp. in Palaman and Hazaribagh. In the Northern area it becomes scarce in Purneah except towards the Morung but it is found sub-gregariously in some grass lands of Northern Champaran. Fl. Feb.-April, at least the upper part of the tree being leafless at the time. Fr. May-July.

On blazing the trees a red juice issues which hardens into a red astringent gum used in diarrhoea and in the indigo-beating vats. It is said to increase the outturn of indigo by 30-40 per cent. The trees are bled in May and June and the gum realises Rs. 6/- to Rs. 15/- per maund. The leaves are used for fodder and manure. The root bark gives a fibre and the flowers a yellow dye. It is one of the principal trees for lac cultivation. It grows easily from seed and succeeds best on cotton soil.

2. *B. superba*, Roxb. Morud, K.; Nari-murup, S.; Dorang, Kharw.; Noi Palas, Palsa-Noi, Or.; Budel, budhla, Gond.

A very large woody climber with the leaflets usually attaining 12-18" and sometimes 20" in young plants, sub-rugose and dull above, green and thinly (or young densely) hairy especially on the nerves beneath, terminal usually sub-rhomboid with obtuse apex. Flowers 1.75-2.5" long, gorgeous orange scarlet borne in great profusion along the leafless branches on racemes often 12" long. Calyx broadly campanulate, lower teeth lanceolate. Pod about 5"-6".

Common in the hill forests of the Central and Southern areas in all the districts! Fl. March-April. Fr. June-July. Leafless Feb.-May.

It climbs from left to right with a trunk attaining 2-3 ft. girth. Bark rich brown, tardily flaking and hence generally smooth, the red juice as in *B. frondosa* contained in tubes between the bast fibres in the cortex; wood normal without concentric rings, with numerous med. rays, scattered large pores often sub-divided and other smaller ones. The spaces between the raised nerves beneath are minutely areolate with depressed nervules and the areoles are pale and glabrous, the appearance is therefore different to the leaflets of *Butea parviflora* which are sometimes confused with this. The fruit is very similar but can be distinguished by the character of the persistent calyx.

Roxburgh remarks that "the colours of the flowers are so vivid that my best painter has not been able, with his utmost skill, to imitate their brightness. When in flower, I do not think the vegetable world offers a more gaudy show."

3. *B. minor*, Ham. (Wall. Cat. 5439) inc. *B. pellita*, H.f. (Kew. Bull. 1908).

A large shrub with several long sub-sarmentose weak stems, not climbing. Stems without, or with very scanty, red juice, densely velvety with a close spreading indumentum, densely yellow-sericeous towards the inflorescence. Terminal leaflet 12-16" broadly elliptic, with rounded not rhomboid base and acute rounded or emarginate apex, lateral similar but smaller and usually obliquely oblong, above sparsely hairy, beneath densely grey hairy-pubescent on the nerves but glabrescent between them with age. Fls. red 9" long in dense racemes which are usually paniced at the ends of the stems, both calyx and corolla densely yellow-sericeous. Pod sub-sessile oblong wider upwards 2-3" by 1.25-1.4" tomentosely hairy with the basal thin portion very short or almost absent.

Sameswar Hills, N. Champaran 2000 ft., on sides of ravines! Fl. Sept.-Oct. Fr. Nov.-Jan. The whole plant dies back to the rootstock after fruiting.

A very interesting plant, never, where I have seen it, a climber. Lifts. with venation as in the other species with usually several sec. n. near the base. Petiole 6-8". Stipules often persistent as semi-orbicular auricles 1" broad. Rhachis of panicle angular. Pedicels 5-7". Calyx 3" with very short teeth. Style hairy.

Eastern Himalayan specimens differ in some respects, especially in the more sericeous less hirsute tomentum, rather larger flowers and longer base to the pod. Our plant more resembles *B. pellita* but is close to *Hamilton's* type and collected near the same region, so that it is the Eastern form, not the Western, which requires renaming if the two are distinct. The description of *B. minor* in *Kew. Bull.*, 1908, appears to have been drawn up from the Eastern form, not from *Hamilton's* Nepal plant.

4. B. parviflora, Roxb. Syn. *Spatholobus Roxburghii, Benth.*; Bandu, Barlan, K.; Cihut, S.; Bibri, Khariv.; Maula, H.; Ram Borla, Th.; Murdha, Or. (When in leaf only it is often called by names applicable to *Butea superba*.)

A gigantic climber with the trunk attaining 3 ft. girth or more. Leaflets 5-10" long, scarcely coriaceous, shortly densely silky or (var. *denudatus, Baker*) glabrescent beneath, terminal elliptic, sub-rhomboid or somewhat obovate, shortly cuspidate, sec. n. 8-10 strong and tertiary scalariform. Fls. cream-coloured or white 35" long. Pod 3-4" long, ferruginous-tomentose, sometimes constricted below the seed, base narrowed suddenly to a stipes 5" long.

Throughout the whole area but only common in the moister forests! Fl. Aug.-Dec. Fr. Feb.-March. Evergreen.

Bark smooth grey, wood with deep red concentric bast bands. The length and character of the leaf rachis between the lateral and terminal leaflets is extremely variable, sometimes only 3" long and stout, at other times slender and 1.5" long. Panicles tomentose, pedicels under 1". Calyx narrowly campanulate (by this character the inflorescence can be distinguished from *B. superba* in fruit), pale tomentose, lower teeth sometimes exceeding the tube, linear-lanceolate.

The seeds give an oil used for cooking and anointing. The bark gives a fibre. The red gum resembles that of *B. frondosa* and lac is sometimes collected both from this and the large-flowered *Butea*.

46. PUERARIA, DC.

Large woody climbers or twining herbs with stipellate 3-foliate leaves, leaflets sometimes lobed. Flowers large or small fascicled on the tumid nodes of long often paniced racemes. Two upper calyx teeth connate. Corolla far exserted, standard spurred or not at base, clawed, about equalling the wings and keel. Stamens monadelphous or distinctly diadelphous, anthers uniform. Ovary not or scarcely stipitate, many-ovuled, style filiform incurved beardless, stigma capitellate. Pod linear, more or less compressed, sometimes constricted between seeds.

Large woody climber flowering when leafless 1. *tuberosa*.
Slender climber flowering with the leaves 2. *phaseoloides*.

1. **P. tuberosa, DC.** Jan Tshira or Chirra, S.; Pathal Kohnra, Khariv.; Pathal, Badra, Gond.; Ban Kumra, H.; Shimia batraji, Beng. (teste Beng. Pl.); Handiphuta, Kataka, Buinka Karkaru, Or.; Marda tunga, Khond.

A very large woody climber flowering when leafless and then very handsome. Lfts. large 6-12" roundish or, more usually, the terminal one rhomboid longer than broad and the lateral very obliquely ovate, easily recognised from other similar woody climbers in the province by being permanently appressed white silky beneath and with scattered thinner appressed hairs also above, the stipellæ are also lanceolate-subulate 2-3" long on the young leaves though they become more inconspicuous with age. Fls. blue-purple ternate on the nodes of racemes 6-18" long. Calyx 3" purple or green, silky. Standard orbicular, clawed, often white, 5" long, slightly spurred or not, sides often revolute and apex emarginate. Stamens usually diadelphous 9+1. Pod 2-3" long, hairy.

Central and Southern area, chiefly on the sides of rocky streams. Hazaribagh, Meebold! Parasnath! Maubhum, Camp.! Ranchi! Palaman! Puri! Angul! Sambalpur! Kalahandi, Cooper! Fl. Feb.-April. Fr. May-June. The leaves drop December to February and are renewed in May.

Tubers usually several, attached to the base of the stem by stout lateral roots and again ending in roots. They thus remind one of the Yams and are probably

morphologically roots, the shape is usually globose-oblong. Stems attain 2 ft. girth. Bark brown, fibrous, peeling off in strips, sometimes twisted. Wood rather soft without bast rings, with many very large pores with distinct walls, sometimes divided, med. rays inconspicuous. Near the pith are sometimes patches of tissue with red juice, but the outer bark has no red juice. Wings of corolla 5" long, falcately oblong with spur above base, obtuse; keel petals free, long-clawed, spurred. Ovary silky, about 10-ovuled, style puberulous. Vexillary stamen rarely slightly connate. Young pod densely brown bearded on the sutures and densely appressed hairy on the faces.

The tubers sometimes attain an enormous size. Campbell mentions one from the Gobindpur sub-division nearly 2 ft. long and 2½ ft. in circumference. They are sometimes cut up, boiled and eaten in Palamau, but their use as food seems to be far from general. In most districts they are used medicinally. Campbell states in Manbhum for renal complaints and to kill fish. In some districts eaten in particular conditions of the bowels, in other districts no use appears to be made of them.

2. *P. phaseoloides*, Benth. Syn. *Dolichos phaseoloides*, Roxb.

Rather a strong twiner but not at all woody. Stems with reflexed hairs, leaflets 3-4" closely appressed-hairy beneath, less so above. Fls. 5" long blue (yellow according to an Indian collector) in axillary racemes 3-6" long or about as long as the leaves, rhachis strigosely hairy. Pods numerous straight linear 2-3" by 15" only, somewhat compressed, clothed with stiff adpressed hairs, 10-14-seeded.

Jungles of northern Purneah! Fl. Sept. Fr. Oct.-Dec. Perennial.

Terminal leaflet broadly rhomboid sometimes as broad as long rarely 5", obtuse or acute, sometimes shallowly lobed, sec. n. 6, of which 1 basal. Petiole densely hairy, 1-1½". Stipules basifixed triangular, 15" long. Stipellæ subulate. Racemes sometimes 2-nate. Pedicels very short, recurved in fruit, so that the pods are strongly reflexed.* Seeds black, oblong, subterete, rough, not shining, with very hard testa and short hilum.

The pods and seeds are more those of a *Phaseolus* than a *Pueraria*.

47. *MUCUNA*, Adams.

Twining shrubs or herbs with pinnately 3-foliolate minutely stipellate leaves. Flowers usually large and usually purple (in our area), mostly fascicled on the tumid nodes of racemes which are axillary or lateral on the old branches or stems. Calyx widely campanulate, anterior lobe longest, upper two connate. Corolla much exserted, petals very unequal, the standard being much shorter than the wings which again are shorter than or equal to the keel, standard auricled at the base. Stamens dimorphous, the longer with basifixed anthers, the shorter with ovate dorsifixed bearded anthers. Ovary and style densely hairy. Ovules 2-many. Pod usually covered with fine irritating pungent bristles. Seeds transversely oblong with short hilum or orbicular with linear hilum.

I. Flowers 1" or more long.

A. Pod oblong with plaited faces.

- | | |
|---|------------------------|
| Lfts. lanceolate. Pod oblong, winged down the sutures | 1. <i>imbricata</i> . |
| Lfts. ovate. Pod elliptic or rhomboid, 2-2½" | 2. <i>monosperma</i> . |

B. Pod linear, faces not plaited.

1. Leaves silky beneath. Fls. purple.

Pod grey with close bristles 3. *prurita*.

Pod black with velvety persistent tomentum var. *utilis*.

2. Leaves glabrescent.

Fls. white. Pod as in last variety var. *nivea*.

Fls. few, purple. Pod velvety, glabrescent var. *capitata*.

II. Flowers about 8" or less 4. *minima*.

* In our specimens, but sometimes the pods are erect. In the closely allied genus *Phaseolus* the position of the pods has sometimes been used to differentiate species!

1. *M. imbricata*, DC. Marang atkir, itikar or etka, K., S.

A large climber with slender sparsely hairy or yellow-setose branches, lanceolate or ovate-lanceolate or elliptic usually acuminate leaflets 4-6" long sparsely shortly yellow hairy beneath, dull purple flowers in pendulous long peduncled racemes 4-6" long and pods about 5" by 2", easily recognised by the two wings on each suture and the obliquely plaited faces. Seeds 2-4, large, flat, with a circumferential hilum.

In the damper forests, N. Champaran! Ravines in Singbhum and Santal Parganas! Parasnath (Hazaribagh)! Angul! Fl. Aug.-Oct. Fr. Dec.-Feb., but pods remain long on the plant and were found on Parasnath in May.

Petiole and leaf-rhachis slender, together about 3-5" long. Petiolules stouter, .25". Stipellæ minute, setaceous. Peduncles usually 6-12" long. Flowers about 8-10, 2-2.25" long. Bristles on the plait ferruginous and style persistent as a hard slender beak.

2. *M. monosperma*, DC. Sarni, Bai-donka, Or.

A large climber with sometimes worted glabrescent branches, ovate broadly ovate or (terminal) sometimes elliptic leaflets, very dark green with red nerves and scanty ferruginous hairs, mostly about 4" long and shortly suddenly cuspidate. Fls. large purple in short-peduncled short racemes about 3-4" long only. Pods sub-globose when young, afterwards ovoid or ellipsoid or rhomboid, 2.5" long, 1-seeded.

Damp forests. Mals of Orissa! Fl. Nov.-Dec. Fr. Feb.-April.

Petiole and leaf-rhachis together 4-6" long. Stipellæ minute, setaceous. Peduncles usually about 1" only and racemes few-flowered. Flowers about 2" long. Pod very bristly when young with slender hardened style-base. The young pod is not winged on the sutures, but some specimens at Kew show the wings in old pods.

3. *M. prurita*, Hook. Syn. *M. pruriens*, F.B.I. (not of DC., teste Gamble); Kivach, H., whence the English name Cowage; Alkusi, Atkir, Etka, K., S.; Bai Khujani, Or.

A slender climber, leaflets appressed hairy beneath, lateral exceeding the terminal semi-cordate-ovate 3-6" long with 6-7 rather strong lateral nerves, terminal rhomboid. Flowers purple, 1.25-1.5" long in rather dense drooping short-peduncled racemes 6-12" long. Pod turgid linear with the ends curved in opposite directions, 2-4" long, densely clothed with brown or grey intensely irritating bristles. Seeds about 6 in a papery endocarp, black and shining.

In dry jungles, very common along riverain forests, throughout the whole area. Fl. Sept.-Nov. Fr. Jan.-April.

Stems sulcate and densely clothed with rigid hairs or with few appressed hairs. Petiole sometimes 10" long.

Various medicinal virtues are ascribed to the plant, some probably imaginary. Campbell states that the root is given for delirium in fever and that a paste made from the powdered root is applied for dropsy. The hairs of the pod are anthelmintic and were at one time included in the *British Pharmacopœia*. Both the root and seeds are included in the Hindu *Materia Medica*. An intoxicating liquor, "khasuna," is prepared from the plant in Palamau. The young pods are eaten as a vegetable after removal of the hairs.

The following are possibly only cultivated varieties of *M. prurita*; they do not occur wild in our area:

7. *MUCUNA*.]

53. *PAPILIONACEÆ*.

a. *M. utilis*, Wall. Alkushi, Beng.; Kursar, Mal Pah.

It scarcely differs from *M. prurita* except in the black velvety pod. "In badly grown plants the racemes are often short and few-fl'd.

Cultivated in Chota Nagpur," Prain.

β. *M. nivea*, DC. Khamach, Beng.

It differs in the leaflets being glabrescent beneath and in the white flowers.

Cultivated in Chota Nagpur, Wood.

γ. *M. capitata*, W. & A. Kursar, Mal Pah.; Kuswa, Kharw.

Branches glabrescent. Lfts. usually smaller than in *prurita*, 2.5-4' long, thinly appressed hairy beneath, sub-equal, petiole often shorter than the leaflet. Racemes in short peduncled few-flowered. Pod purple 5-6", bristles at first dense subsequently few and deep brown or blackish, when dry marked with faint oblique grooves.

Palaman! Rajmahal Hills!

As the pod may sometimes be described as black and velvety, this may be the same as *utilis*.

4. *M. minima*, Haines (Jour. As. Soc., xv, 7).

A very slender climber with sulcate thinly hairy stems, leaves with the petiole only 2-3" long, terminal leaflet broadly elliptic or obovate 1-1.5", lateral leaflets exceeding the terminal, very gibbous. Flowers only .75-.8" long in a few-flowered axillary cluster. Pod not seen.

Forest near Larasara, Sambalpur!

Fl. February.

Leaflets sericeous beneath and less so above, apex rounded, sec. n. 3-4. Petiole 1-1.5". Stipellæ filiform. Pedicels .15". Calyx .35-.4" densely sericeous, lowest tooth lanceolate about as long as the tube. Keel .75". Standard .5", nearly glabrous, wings slightly shorter than the keel, narrow. Upper part of filament of stamens with dorsifixed anthers dilated, free part of posterior filaments very long. Ovary linear and style densely hairy. Ovary 2-ovuled.

48. *ERYTHRINA*, L.

Trees with prickly branches or (*E. resupinata*) an undershrub with pinnately 3-foliolate leaves and gland-like stipellæ. Fls. red, showy, with spathaceous or two-lipped calyx and very unequal petals, the standard much exserted and exceeding the wings and keel. Upper stamen nearly free or connate with the others half-way up. Ovary stipitate many-ovuled. Pod linear turgid, septate usually more or less torulose.

I. Trees.

A. Calyx oblique spathaceous and splitting.

Calyx split to base, tip 5-toothed

Calyx split half-way down, apex entire 1. *indica*.

B. Calyx not spathaceous but two lipped.

Lfts. broadly ovate or rhomboid 3. *rubrosa*.

Lfts. elliptic, much longer than broad 4. *ovalifolia*.

II. Undershrub. Calyx 2-lipped 5. *resupinata*.

1. *E. indica*, Lamk. Marar, S.; Pharar, Kharw.; Palita-mundar, Beng.; Hadbad, Ghatw.; Pharad, Pangra, H.; Indian Coral Tree.

A prickly tree with the prickles small and black. Shoots at first densely tomentose but leaves quickly glabrescent, leaflets 3-6",

broadly deltoid or base of terminal sometimes rounded or sub-rhomboid. Racemes very elongate usually 6" excluding the peduncle which is about 4" long. Flowers brilliant scarlet. Calyx split spathaceous with very oblique mouth, persistent and ultimately recurved, 5-toothed at the narrow tip. Pods many, 6-10" long, beaked, somewhat curved, narrowed into a seedless base and a stout stipes 7.5-1" long, torulose, 6-12-seeded, somewhat stellate-pubescent.

Often planted. Rare in Purneah, *Ham.*; Ranchi! Palamau! Khandpara and Banki! Common in Khurda, where it is perhaps wild! Fl. March-April. Fr. April-July. Deciduous up to the time of flowering.

Bark smooth and greenish after the papery exfoliations, branchlets less stout than in the next. Stipellæ short swollen reflexed finally hard, sec. n. 4-5, of which one from the base. Standard about four times as long as the wings. Fruiting pedicels stout about 6". Seeds 6-7" dark purple.

The wood is little used but *Gamble* says it is fairly durable although light and soft. "Wt. about 19 lbs. only." The bark is used as a collyrium in ophthalmia. The tree is very ornamental and grows easily from cuttings and is used in some parts of India for supporting the Black Pepper (*Roxb.*).

2. *E. stricta*, *Roxb.*

A large or mod.-sized tree with the stout branchlets very closely beset with sharp yellow prickles 1.5-2" long. Lifts. hairy beneath when young, glabrescent, 3-6" long and broad, broadly deltoid, base often rhomboid or rounded. Racemes under 3" long on peduncles the same length. Flowers crimson, 1.8-2" long. Calyx split, spathaceous, pubescent 4", not toothed at the tip. Pod not at all torulose (in our specimens), slightly curved, 4-6.5" long by .7" wide, with a slender stipes .5-1.3" long and persistent spathaceous calyx; often beaked with the slender style. Seeds 4-5", oblong.

Orissa. Chandka, Puri, *Gamble*! Sometimes planted! Fl. Jan.-Feb. Deciduous up to the time of flowering.

A much larger tree than the last. Bark pale smooth greenish after the papery exfoliations as in the last. Standard about 4" wide but if unfolded 7.5" wide and lanceolate.

3. *E. suberosa*, *Roxb.* (inc. *E. sublobata*, *Roxb.*). Piri, K.; Buru Marar, S.; Pharar, *Kharw.*; Paldua, Chaldua, *Or.*; Baldia, *Gond.*

A small very prickly tree with thick corky bark and leaves covered with white-brown tomentum beneath (exc. var. *glabrescens*). Fls. scarlet in sub-capitate racemes. Calyx persistent turbinate 2-lipped. Pod scarcely torulose (torulose *F.B.I.*), much as in *E. stricta*, narrowly spindle-shaped, 4-6" long including the slender stipes, about 4" wide in the middle. Seeds 2-3 only.

In hilly districts throughout the province! Fl. March-May. Fr. April-June. Leafless up to June.

Rarely attains 5 ft. girth. Bark deeply furrowed, blaze thick yellowish. Prickles usually straw-coloured. Shoots densely tomentose. Terminal leaflet 6-9" broad, not as long, base usually rhomboid or sub-cuneate, sec. n. 5-6, one from base. Petiole 6-7" tomentose. Racemes 1.5-3" long (excluding the peduncle). Standard 3-4 times as long as broad and twice the keel.

Var. *sublobata*, *Roxb.* Leaflets lobed or lobulate, very tomentose beneath. Monghyr! Hazaribagh! Parasnath!

Var. *glabrescens*. Lifts. almost glabrescent beneath. It may be distinguished from *E. stricta* by the areoles (between the reticulations) less conspicuous and not white. Champaran Hills!

The bark yields a good cordage fibre of a pale straw colour. The wood, ash, and bark are used for dyeing, and the bark is also used in medicine.

E. ovalifolia, Roxb. Hari-kekra, Beng.

A mod.-sized much branched tree with scattered pale-coloured prickles which often extend even on to the leaves and leaflets. Easily recognised, distinguished from any of the preceding by the elliptic or ovate-elliptic leaflets. Flowers crimson, mostly 3-nate on the rachis of the raceme. Calyx pubescent, often irregularly splitting. Standard twice the keel, broadly obcordate with a long claw. Pod about 6", torulose at least on one side, 6-8-seeded.

Puri! Perhaps only planted. Fl. Feb. also May. I have seen new shoots in September but it probably renews its leaves also at the end of the hot season like the others.

Bark pale brown thick and fluted or somewhat cracked. Prickles sometimes with black tips, very sharp and more slender than in the others. Lfts. 4-6" long, rounded at tip, very pale beneath and minutely reticulate, glabrescent, sec. n. 6-8 of which one from base.

5. E. resupinata, Roxb.

An undershrub with shoots a few inches high, dying down annually, leaflets about 2.5" long and broad, roundish or terminal rhomboid, lateral smaller, sometimes ovate or ovate-lanceolate, obtuse, tomentose or pubescent beneath, glabrescent? Petioles and nerves usually somewhat prickly. Racemes about 4-6", short-peduncled, often appearing before the leaves. Fls. bright scarlet. Calyx 2-lipped. Standard elliptic far exceeding the small obovate nearly colourless wings. Pod not seen.

Higher plateau of Chota Nagpur. Neterhat, 3000 ft.! Parasnath! Fl. March-April. It occurs in Oudh and will very likely occur in Champaran.

49. PHASEOLUS, L.

Prostrate, sub-erect or twining herbs with 3-foliolate stipellate leaves and conspicuous stipules sometimes peltately attached. Fls. fasciated on the swollen nodes of axillary racemes. Calyx campanulate with the two upper teeth connate or not. Keel of corolla spirally beaked. Stamens 9+1. Ovary sessile, many-ovuled, style twisted with the keel, conspicuously bearded on the inner face (or, owing to torsion, on the side) below the very oblique stigma. Pod linear, rarely oblong, sub-terete or compressed, with usually thin septa between the seeds.

I. Stipules not produced at their base. Fls. rarely yellow.

Pod over 3" broad, curved, 2-4-seeded.

A. Pod oblong. Fls. whitish or yellowish green 1. *lunatus*.

B. Pod linear. Fls. medium-sized.

Bracteoles large, exceeding the calyx. Fls. lilac to white 2. *vulgaris*.

Bracteoles shorter than the calyx. Fls. scarlet, rarely pinkish 3. *multiflora*.

II. Stipules produced below the base (peltate). Fls. yellow.

Pod under 3" broad.

A. Pods glabrous or puberulous, terete or sub-compressed, straight.

1. Pods terete, seeds rounded at ends.

Stipules oblong. Lfts. shortly lobed 4. *trilobus*.

Stipules lanceolate. Lfts. deeply lobed 5. *aconitifolius*.

2. Pods sub-compressed. Seeds truncate at the ends.

Lfts. usually repand, scarcely lobed 6. *calcaratus*.



B. Pods hirsute, sub-compressed.

1. Wild. Stems twining and pods distinctly septate . . . 7. *sublobatus*.
2. Cultivated. Stems sub-erect or shortly twining. Pods sometimes not septate. Septa sometimes evanescent.
 - a. Pods erect or sub-erect (*mungo*).
 - Sub-scandent, seeds black 8. *mungo*.
 - Diffuse. Seeds black with grey spots (9.) *Roxburghii*.
 - b. Pods spreading or reflexed (*radiatus*).
 - Seeds green, pods patent 10. *radiatus*.
 - Seeds yellow, pods reflexed (11.) *aurea*.
 - Seeds black, pods patent (12.) *grandis*.

NOTE.—The above key is mainly after *Prain* in *Bengal Plants*, but he defines two species, viz. *mungo* and *radiatus*, and treats the others (shown in brackets) as varieties of these two. I look upon all of the species 8-12 as varieties derived from *sublobatus*. The position of the pod is not a satisfactory character. *Gamble* (*Madras Flora*) adds "seeds black" in the definition of *P. mungo* and "seeds green" in that of *P. radiatus*. This would reduce *P. grandis* to a variety of *mungo*, whereas *Prain* considers it a variety of *radiatus*!

Baker in *F.B.I.* reduces *P. radiatus* to a variety of *P. mungo*.

1. ***P. lunatus*, L.** Rangoon Bean, Sugar or Lima Bean.

Twining with pubescent but often glabrescent stems. Lfts. 2-4" long, nearly glabrous, terminal tapering-rhomboid. Racemes usually short, 1-3.5", hairy. Fls. hairy, 17-25", usually 3 to a node. Pod 2-2.5" long by .6-7" broad, somewhat curved, shortly beaked, glabrous, seeds 2-4 large, usually white, sometimes purple.

Occasionally cultivated, chiefly in Orissa. Fl. Aug.

It is said to be injurious to cattle, owing to prussic acid, which, however, is dissipated in cooking.

2. ***P. vulgaris*, L.** French Bean, Haricot Bean.

Glabrous or nearly so, twining or low and suberect (var. *nanus*), Lfts. thinly hairy, terminal rhomboid with rounded sides and slightly tapering tip, 2.5-3.5" long. Racemes 1.5-7", axillary very lax. Fls. pale-coloured, slender-pedicelled, in pairs on the not much thickened nodes, easily recognised by the very conspicuous large nerved bracteoles embracing the flower and exceeding the calyx, ultimately spreading, .3" long. Pods about 3-5" by .4", beaked.

Often cultivated in European gardens.

Roxburgh says the bracts (bracteoles) are shorter than the calyx, evidently following *Willdenough*, who made this mistake.

3. ***P. multiflorus*, Willd.** The Scarlet Runner.

Stem twining. Flowers geminate, scarlet, in many-flowered racemes as long as the leaves, the two bracteoles appressed to and shorter than the calyx. Pods long pendulous.

Occasional in European gardens. A native of Mexico.

4. ***P. trilobus*, Ait.** Mugani, Rakhal-kalai, H.

Stems trailing 1-2 ft. long, glabrous or hairy. Lfts. very variable in size usually shorter than their petioles, nearly always lobed, lobes usually three shallow and rounded, in the wild plant sometimes deeply lobed, but lobes broad obtuse or rounded and sub-spathulate. Stipules oblong or ovate-oblong, very large, 3-5", attached above their base. Stipellæ small, but spreading and foliaceous. Racemes capitate or spiciform, long-peduncled. Fls. about 2-2.5" long.

Bracteoles ovate. Pods narrowly linear about 2" long, only about 1-12" broad, glabrous, sometimes curved. Seed 6-12, grey, small oblong with rounded ends, lineolate.

Apparently wild. Behar, *Hope*! Manbhūm! Puri, *Hooper*! Fls. chiefly r.s. The seeds are gathered and eaten by the poor. Cattle eat the plant.

5. *P. aconitifolius*, Jacq. Moth, H.; Bir-moch, S.; Mung, K.

Stems numerous, trailing for several feet, often very hairy. Lfts. always deeply lobed and the lobes often again lobed, lobes linear or lanceolate and acute, somewhat hairy. Petioles longer than the leaflets. Stipules sharply lanceolate, 2" rarely 3", and stipellæ linear or subulate. Racemes usually capitate, flowers 2" or less, but standard 25" broad. Bracteoles linear-setaceous, far exceeding the minute calyx. Pods 1-2" long, 15-17" broad. Seeds often 7-8.

Doubtfully wild, often cultivated. *Campbell* says that it is wild in dry situations in Manbhūm, and the Santal name supports this. Santal Parganas, *Wood*! Cultivated in Ranchi, Singhūm, etc.! Fl. chiefly Sept.-Oct. Fr. Oct.-Nov.

The grain is eaten and the plant used for fodder.

6. *P. calcaratus*, Roxb. Sutri, H.; Bir Mung, S.

A slender twiner. Stems with spreading hairs. Leaves long-petioled. Lfts. 2-4", terminal rhomboid-ovate repandly 2-lobed or wavy each side, rarely some lanceolate and entire, both sides hairy. Stipules large peltately oblong, 4-5", hairy and ciliate, 12-nerved above. Racemes 25" elongating to 1" with peduncle 1-3". Pod never with long hairs, hirtellous or puberulous.

Wild in Sal forests in Singhūm! Abundant in a wild state in high dry jungle lands. Manbhūm, *Campbell*! Lohardaga, *Clarke*! Palamau forests! Koderma forest! Santal Parganas, *Kurz*, *Wood*!

Fl. Aug.-Sept. Fr. Sept.-Nov.

Lfts. often softly hairy both sides, broad-ovate or rhomboid or upper quite narrow, always some wavy or lobulate, larger 4" by 3" rarely up to 5". Peduncles 2-4". Fls. yellow, 32" broad. Bracteoles setaceous. Pod 1.75", 9-12-seeded, seeds brown, not shining, small .05" or less, truncate both ends.

The seeds are eaten.

Very closely allied to *P. sublobatus*, but probably distinct, the very small short appressed hairs on the pods very constant in character. But it is doubtfully *Roxburgh's* plant which has quite glabrous pods. *Roxburgh* states that the *carina* has a remarkable long horn on the right side (when looking at the back of the keel). My specimens are unfortunately not in a state to determine this.

7. *P. sublobatus*, Roxb. Ghora Mung, Beng.

A twiner with branches and petioles brown-hairy, 3-foliolate leaves with leaflets sparsely setosely hairy on nerves beneath and rather more so and also hispidulous above, terminal mostly ovate lanceolate with a rounded lobe each side, lateral often sub-lobed. Racemes often on leafless slender branches. Fls. capitate sub-sessile or pedicelled. Pods spreading terete (or compressed in *Herb.*) with rather rigid ascending hairs, about 12-seeded. Seeds terete 1-12" dark grey with longitudinal wavy lineoles. Stipules large oblong 2-45".

Wild in the forests. Palaman ascending to 3000 ft.! Ranchi! Parasnath, 4000 ft. *Clarke*! Fl. Sept. Fr. Oct.-Nov. Annual.

Var. *a typica*. Very slender. Lfts. 2-3". Petiole 1.25-1.75". Stipules 2-3" sparsely ciliate. Stipellæ 2" setaceous exceeding the petiolule. Peduncles 4-7"



stipulose hairy. Racemes 2" few-fl'd. Bracts oblong-lanceolate. Pods 1-3" thinly septate. Netherhat 2500-3000 ft.! Parasnath!

Var. β **robusta**. Stouter and more densely hairy. Lfts. 3-4". Petiole 1.5-2". Stipules 3-4.5" strongly 8-nerved and strongly ciliate. Racemes up to 8". Peduncles 3-6". Pods 1.5-2" by .18". Palamau and Ranchi forests!

This last comes very close to the cultivated *P. radiatus*, L., esp. var. *grandis*, which, however, has got perfectly smooth seeds.

8. **P. mungo**, L. Urid, mashkalai, tikari-kalai, Vern.; Ramra, Kol.

A cultivated diffuse or shortly scandent herb with often twisted stems with spreading or reflexed hairs sometimes glabrescent. Lfts. ovate lanceolate or ovate sometimes slightly lobed. Stipules 6-12-nerved 3-5" oblong, often hairy and sometimes ciliate. Pod 1-1.3" rarely more, erect or ascending, hairy. Seeds 4-6 black or black mottled grey, smooth.

Chota Nagpur, commonly cultivated! Santal Parg., Kurz! Probably throughout the province. A cold weather crop.

Both this and *P. radiatus*, L. are probably cultivated forms of the indigenous *P. sublobatus*. The flowers are a purer yellow than in *P. radiatus*.

(9.) Var. **Roxburgii**, Prain Syn. *P. radiatus*, Roxb. (in *F.I.*); Mash Kalai, Beng. is the suberect or diffuse form with seeds (f. *Prain*) grey only. I am inclined to think the colour rather variable. I have seen brown seeds in forms with erect pods. Indeed all the characters seem very variable.

Roxburgh describes it as diffuse and hairy. Lfts. elliptic. Stipules lanceolate. Horn of the keel very long. Pods straight hairy terete nearly erect 2" long, very hairy. Seeds small, 4-6, black with grey spots.

He states that it is the most esteemed of all the Leguminæ. Cattle eat the straw of this variety and it is considered very nourishing.

10. **P. radiatus**, L. Syn. *P. Mungo* var. *radiatus*, *F.B.I.*; Mung, H., Beng.

A cultivated plant rarely more than a foot high. Stems with spreading hairs or hairs somewhat reflexed. Lfts. sparsely setosely hairy, variable in size according to cultivation, usually 1-3". Stipules 3", 5-7-nerved usually ciliate. Racemes under 5" usually 3" but occasionally sub-panicled. Pods 1.5-2.5" by .2-2.2" spreading or reflexed, hairy when young with hairs inclined forwards but usually glabrescent. Seeds smooth.

Cult. apparently throughout the province.

Var. α **typica** (*P. mungo*, Roxb.). "Pods spreading, seeds green," *Prain*. Balasore! Burdwan! A common field crop.

(11.) Var. β **aurea** (*P. aureus*, Roxb.). "Pods reflexed, seeds yellow," *Prain*.

(12.) Var. γ **grandis** (*P. Mar*, Roxb.). Krishna Mung, Beng.; Mash Kalai; Urid, H. "Pods longer, spreading. Seeds black," *Prain*.

This last is very close to *P. sublobatus* var. *robusta* (q.v.), but the wild plant is a good climber and seeds not so smooth. One specimen has the leaflets somewhat lobed. *Baker* is probably more logical in reducing *P. radiatus* to a variety of *P. mungo* (q.v.)

50. VIGNA, Savi.

A genus only separable from *Phaseolus* by the keel petals, which are not spirally twisted, though often incurved.

Even this character often fails in *V. vexillata*, which I only retain in *Vigna* instead of *Phaseolus* for uniformity with other floras.

The stigma is sometimes large and capitate, situated on the inner face and with the minute horn-like appendage often more dorsal than in *Phaseolus*.

- I. Keel with an incurved beak. Pods hairy, at least when young.
Standard 1.25" diam. Pod with short brown hairs 1. *vexillata*.
Standard 8" diam. Pod densely pubescent and hairy 2. *pilosa*.
- II. Keel scarcely beaked. Pod glabrous.
Cultivated, twining or sub-erect 3. *catjang*.

1. **V. vexillata**, Benth. Syn. *Phaseolus vexillatus*, L.; Serwang, Bir Ghangra, S.

A slender twiner with tuberous roots and scabrid stems. Lfts. narrowly lanceolate, rarely ovate-lanceolate, usually about 6.5" by 1.75", often flushed white near the mid-rib, scabrellous above and on the ribs beneath, base rounded. Fls. large pale-purple in few-flid. heads on very long peduncles, vertically compressed with keel sometimes spirally curved. Pods narrowly linear straight, 3-4" long by .2" broad, with sparse short brown hairs, 15-20-seeded.

Frequent in the forests of Chota Nagpur, edges of fire-lines, etc. Singbhum, chiefly on the Porahat ghats! Hazaribagh! Ranchi! Manbhum, Camp! Fl. July-Oct.

Petiole 2-3" long. Peduncles 6-9" long, the raceme very short and often only 2-3-flowered with very short pedicels. Pod glabrescent.

The roots as well as the beans are eaten by the Kols and Santals.

2. **V. pilosa**, Baker. Syn. *Dolichos pilosus*, Roxb.

A twiner with hairy stems. Terminal leaflet lanceolate acuminate about 7" by 3", shortly hairy both sides, base 3-nerved; lateral rather shorter sub-falcate with very oblique base. Peduncles not longer than the 1"-1.75" long raceme. Flowers pale purple .7" long with standard .8" broad. Pod 4-5.5" long, slightly compressed, nearly straight, about .3" wide, beaked, densely pubescent and hairy, about 10-12-seeded. Seeds oblong, shining black .2" long.

Singbhum, Songra forest, near streams! Fl. Oct.-Nov. Fr. March. Perennial. Hairs appressed or in young parts spreading and of two lengths. Stipules narrowly lanceolate basifixed 15". Petioles of larger leaves 3-3.5" long much thickened below, pubescent, 2-margined above. Lfts. paler beneath. Calyx-tube .17" slightly gibbous covered with small appressed brown hairs, lower tooth lanceolate as long as tube, upper lip extremely short, notched. Wings with very slender claw and basal spur as well as a short hooked spur below the rounded apex, keel with an incurved not at all spiral beak. Pedicels .1".

3. **V. catjang**, Endl. Syn. *Dolichos Catjang* and *D. sinensis*, L.; Barbati, Beng.; Badbadi, Kharw.; Lobia, Ransi, H.; Ghangra, S.; Rambara, M.; Galjaramba, Ho.; Bodi, Rewas, Uran.

Erect with long trailing branches or twining. Stems striate hispidulous or glabrous. Terminal leaflet rhomboid 2.75" and nearly as broad, nearly glabrous or attaining 5" and sub-hastately 3-lobed and lanceolate, the side lobes, if present, very rounded, base always very obtuse, glabrous and rather shining beneath and faintly puberulous above; lateral leaflets about as long as terminal, very unequal-sided. Flowers mostly geminate at the nodes, nearly 1", pale-yellow with purple wings or tinged purple, in the twining form often quite 1" with pale blue and white corolla. Standard .75-1"

diam. sub-orbicular with 2 ridges and 2 small callosities above the claw. Keel carinate. Pod long linear sometimes 1-2 ft. and 3" broad with 15-23 seeds. Seeds usually white 3" subterete.

Cultivated in all the districts either with other crops or trained on trees and trellises or as a separate field crop.

Fl. chiefly Sept.-Nov. Fr. Oct.-Dec. or later.

Petiole 3-5" long grooved and often sub-alate above, rhachis of terminal leaflet often over 1", similar. Stipules 5-9" long, oblong acuminate attached near the base but with a broad lanceolate often curved auricle, rarely (in the twiner) only 3" and spurred. Stipellæ small ovate or tumid or oblong. Peduncles striate shorter than or much longer than the petiole. Racemes very short 5-1" hispid. Calyx 3" long with campanulate tube about as long as the subequal narrow-lanceolate teeth, sometimes tuberculate or transversely rugose.

Var. *typica*. Pods erect about 5", 6-12-seeded, expanded or sub-truncate at the tip, seedless both ends. Ramba, Bodi, Vern.

Var. *sinensis*, Willd. (sp.) Pods very long, 1-2 ft., pendulous, 15-23-seeded, torulose, usually twining. Galjaramba, Ho., Daonbodi, H.

The whole pod is eaten cooked.

Pachyrhizus angulatus, Rich. (Syn. *Dolichos bulbosus*, L.; Sankalu, Beng.), is a robust climber which is fairly widely cultivated in the moister regions but has so far not been seen by me in our area though it is very probably cultivated in Orissa. The genus differs from *Pueraria* in the style being flattened upwards and being bearded within below the stigma, and from *Phaseolus* in the keel not being at all spiral. The plant has large tuberous roots which are eaten, sharply angled or very acutely sub-lobed leaflets, and long racemes of handsome blue flowers. The pod is compressed about 5-10" long, much depressed between the 8-12 round flattened seeds. Roxburgh says it is cultivated throughout the Malay Islands for its roots, which resemble a turnip in taste.

52. DOLICHOS, L.

Twining, more rarely sub-erect, herbs with stipellate 3-foliolate leaves and small sub-persistent bracts, bracteoles and stipules. Fls. small or m.s., axillary or racemed, much as in *Vigna*, but the incurved keel not at all twisted and stigma terminal without a dorsal process. In many species, too, the style is hairy all round the stigma instead of being bearded on the inner face. Pod flat, linear or oblong or sub-oblong and wider in middle or upwards, curved, usually tipped with the style. Seeds not or somewhat flattened, sometimes with a thickened and sub-persistent funicle.

Style thickened upwards, bearded on the inner face 1. *lablab*.

Style slender, hairy all round the stigma.

Root tuberous. Flowers on a slender bracteate peduncle 2. *falcatus*.

Root annual. Flowers 1-3 axillary 3. *biflorus*.

1. **D. lablab**, L. Inc. *D. lignosus*, Roxb., not of *Linnæus*; Sim, Sirmi, K.; Malhan, Malal, S.; Shim, Beng.

A rather powerful climber, or in some forms dwarf and sub-erect with sarmentose branches. Lfts. pubescent both sides, but especially on the nerves beneath, terminal 2-4", rarely 6", long and broad, broadly ovate or deltoid, shortly acuminate, base strongly 3- or 5-nerved. Flowers red, purple or white in racemes which are axillary 3-6" long or terminal and attaining 9" excluding the peduncle. Nodes tumid with 1-4 flowers 75" long. Calyx campanulate, 25", subequally toothed, standard 6-75" broad, keel rostrate. St. diadelphous. Style bearded down the inner face. Pod white to purple and usually shining, sub-lunate-oblong or wider above the middle,

2-3" long, tipped with the sharply bent style. Seeds with their axis at right angles to sutures about .5" long, rarely (in variety) with long axis parallel to suture, and then pod loses its normal shape and is longer. The sutures have a characteristic crisped or crenulate appearance.

Cultivated in all districts and one of the commonest climbers near the houses of the natives. The dwarf variety is less cultivated than in the Central Provinces. Fl. Oct.-Jan. Fr. c.s.

Stems pubescent or puberulous. Petioles 2-6". Stipules lanceolate .15-.2" long. Stipellæ variable in shape usually as long as the petiolule. Pedicels under .1". Bracteoles appressed to calyx, oblong, ciliate, .06".

Var. *lignosus*, Roxb. sp., has longer linear-oblong pods less curved (see above). The racemes long and erect. It is the form usually grown as a dwarf and kept for the seeds, which are eaten.

In the usual short-podded form the bean is usually eaten before the seeds ripen.

2. *D. falcatus*, Klein. *D. falcatus*, Willd. (F.I.).

A slender climber with rather small 3-foliolate leaves and simple and 3-lobed leaflets sometimes with a pale patch in the centre. Fls. yellow (or blue-purple, Roxb.), .5", in a very slender usually short lax few-fl. raceme or solitary on a slender bracteate peduncle. Pod pale, flat, curved, 2-3" by .4", with 5-8 somewhat kidney-shaped seeds .3" long.

Hill forests of Puri! Fl. Fr. Nov.-Dec.

Root a fusiform tuber. Branches with fine spreading hairs. Lfts. 1-1.5" or a few up to 2.3" with few short fine adpressed hairs both sides. Peti. slender 1-2". Stipules lanceolate .1" reflexed. Calyx .17". Funicle very broad.

Roxburgh's drawing marked *Dolichos trilobus* 289 (Cal. Herb.) is this.

3. *D. biflorus*, L. Hore, M.; Hoe, Ho.; Horec', S.; Kurti, Kulti, H.; Kulthia, Or.; The Horse-gram.

A sub-erect villous herb with sub-scandent branches or, in the wild form, twining and less hairy. Lfts. .75-1.75" long lanceolate to ovate-lanc. or ovate-oblong, hairy both sides and often reflexed. Fls. very pale yellow with a crimson spot on the standard, 1-4 together axillary, .45" long. Pod curved, very slightly so in the wild form, linear or broadly-linear, 1-1.7" long, thinly appressed-villous or sub-glabrescent. Seeds 4-6, reniform, grey.

One of the commonest field-crops in Chota Nagpur and frequently cultivated also in all other districts. Fl. Sept.-Nov. Fr. Oct.-Dec.

This appears to be an indigenous plant in India but not perhaps in our area. The calyx-teeth are very long and setaceous, about three-fourths as long as the flower.

Easily grown and eaten largely by the aborigines but is inferior, and in the more cultivated districts is used chiefly for cattle food. The straw is also used as fodder.

The orbicular-cordate cotyledons are long persistent.

53. CLITORIA, L.

Twining herbs (in our area) with pinnately 3-7-foliolate leaves and persistent striate stipules. Flowers large showy, axillary or paired on the rachis of axillary racemes. The genus differs from the allied genera in the standard far exceeding the wings and keel. Stamens diadelphous. Ovary stipitate. Style incurved, flattened, bearded along the inside below the capitate, not oblique stigma. Pod linear, flattened or turgid.

1. *C. ternatea* L. Aparjita, Beng. The Mussel-shell Creeper.

A very beautiful slender twiner with pinnately- (mostly) 5-foliolate leaves, elliptic leaflets 1-2" long and azure blue, more rarely pure white, flowers 1.5-2" solitary on axillary peduncles with large foliaceous persistent bracteoles and the spoon-shaped standard expanding under the wings. Pod flat linear about 3.5" long.

Very common in gardens and as an escape. Fl. chiefly in the r.s. Fr. Nov.-Dec.

54. DALBERGIA, L.f.

Trees or shrubs, sometimes scandent. Leaves pinnate with alternate exstipellate leaflets. Fls. rather small in axillary or terminal panicles. Corolla usually only shortly exerted, wings oblong as long as the broad standard, keel obtuse with the petals joined at the tip. Stamens 9 or 10 monadelphous or 5+5 diadelphous, rarely 9+1. Ovary stipitate, few-ovuled. Style short, stigma capitate. Pod thin flat, usually oblong and veined opposite the seeds, indehiscent. Seeds 1-4.

The pods usually remain long on the tree. The seeds germinate within it after the pericarp has become so softened by the first monsoon rains that the radicle can penetrate it.

Root suckers are very common in the genus.

I. St. monadelphous in a sheath split above, rarely the tenth stamen casually free

A. Trees. Leaflets large roundish.

Lfts. 3-5 cuspidate. Corolla yellowish 1. *sissoo*.

Lfts. 5-7 obtuse or emarginate. Fls. white. 2. *latifolia*.

B. Shrubs, ultimately climbing. Fls. white.

Lfts. 5, sec. n. 2-4. Fls. 2-2.5" 3. *candensis*.

Lfts. 5-7, sec. n. many. Fls. 3" 4. *rubiginosa*.

Lfts. over 20 5. *tamarindifolia*.

II. St. diadelphous 5+5, sheath split above and below.

A. Climbing shrub. Lfts. 11-13. Fls. purplish 2.5" 6. *volubilis*.

B. Erect trees.

Lfts. 5-1.5". Fls. 3" standard oblong 7. *paniculata*.

Lfts. .75-2.5". Fls. 3-5" standard orbicular 8. *lanceolaria*.

C. Erect or climbing, thorny. Lfts. 7-9. Fls. 12" 9. *spinosa*.

1. *D. sissoo*, Roxb. Shisham, H.; Sissu, Nep.

A large handsome tree, lfts. 3-5 usually 5, broadly ell., ovate or obovate or orbicular, cuspidate or acuminate, 1-3" long. Fls. small yellowish, sub-sessile, secund on the branches of dense, densely pubescent axillary panicles 2-3" long. Stamens 9. Ovary long-stipitate pubescent with very short style. Pod strap-shaped with cuneate base 1-3", 1-3- rarely 4-seeded.

Indigenous along rivers in Northern Chantparan and the Mechi river in Northern Purneah, but the rest of the northern area seems just outside its natural distribution. It is however commonly planted throughout the province, especially in the northern districts! Fl. with the new leaves March-April. Pods ripen in the next c.s. and usually remain on the tree until it again flowers, and the seeds germinate in June-July. Partially deciduous Dec.-March.

Attains 6-12 ft. girth with grey or pale brown thick bark exfoliating in narrow longitudinal strips. Shoots pubescent. Corolla twice the calyx or less, standard orbicular long-clawed.

A beautiful timber and yielding one of the handsomest furniture woods. The transverse strength is very great: Gamble gives the value of P as 700-900. It forms

the best of wooden wheels and one of the best for all implements requiring strength and elasticity. "Its weight varies from 42-52 lbs." (*Gamble*). It grows very quickly when young. Planted trees in the compound of the manager of the Bettiah Raj actually showed a girth of 8 ft. in 20 years (if the age furnished by the manager was correct) and the average of seven 3-year-old *Sissou* was 6" girth per annum.* For sowing an absolutely clean seed-bed is required and thus natural reproduction only takes place as a rule in new river silt. It is an excellent fuel and makes a splendid charcoal but its light cover renders it a poor avenue tree. It requires a light soil.

2. *D. latifolia*, *Roxb.* Setisar, *Th.*; Kiri, *K.*; Satsayer, *Mahle, S.*; Pahari-Sissu, *Sitsal, H*; Blackwood, Rosewood.

Usually a small tree except in the south of our area. Leaves odd-pinnate with 5-7 very unequal-sized leaflets on the same rhachis, lfts. sub-orbicular with round or emarginate tip, glabrous 1-4" long, petiolule 25-4" long, pale beneath. Fls. pure white in very numerous lax panicles 2-4" long axillary and from the leaf scars. Pods 1.5-3.5" by .75" stipitate, 1-3- rarely 4-seeded.

Northern area, in the Sameswar Hills! Not uncommon as a small tree especially on cool aspects in the Southern and Central area. Often a large tree in the Southern area. Fl. Sept. when the tree is in full leaf. Fr. Jan.-Feb.

Attains 7.5 ft. girth in the Jacobo Block, Angul! Over 3 ft. in the Rajmehar Hills! Bark light-coloured, blaze green then pale yellow. Pedicels and calyx 12-17". Corolla twice as long. The pods sometimes constricted at the sutures between the seeds.

This is as valuable a wood as the true *Sissu*, indeed it appears to me to be a more handsome furniture wood and it is in as great demand for gun-carriages and other articles requiring great strength, but in our area it is too scarce to supply a large demand and it should be artificially propagated in Angul. *Gamble* gives the value of P as between 822 and 1052! and the weight as 50-70 lbs.

The reproduction under shade in the Baghmunda forest of Angul in good soil is excellent. The growth of trees raised by me from seed in Chaibassa was on an average of 32 ft. in height and 18" girth in 16 years, but the locality is entirely unfavourable.

3. *D. candanensis*, *Prain.* Syn. *D. monosperma, Dalz.*; *D. torta, Grak.*

A climbing shrub frequently with very lenticellate branchlets spirally coiled round supports. Leaves small, leaflets usually 5 obovate rounded at tip or emarginate .8-1.8" long with sec. n. 2-4 only very fine scarcely distinguishable from the reticulate nervules. Fls. white .2-.25" long in short simple or branched racemes, .7-1.5" long axillary and on lateral abbreviated branchlets. St. 9-10 monadelphous. Ovary linear stipitate 1-2-ovuled. Pod flat, rather thick, sub-lunate, .9 by .4", rarely 2-seeded and larger.

Tidal forests of the Mahanadi delta! Fl. May.

Leaf rhachis .8-2" lfts. with sparse short adpressed hairs beneath; petiolules .02-1". Rhachis of racemes rusty pubescent. Calyx green with short rounded or obtuse teeth. Petals with claws longer than the calyx. Standard ovate slightly auricled.

4. *D. rubiginosa, Roxb.* Kanchanai, *Or.*

A dwarf bushy or scandent shrub with rusty pubescent shoots, small odd-pinnate leaves with 5-7 ell. or oblong, somewhat obovate leaflets .5-2.5", and white or cream coloured flowers .3" in short

* Vide Report on the Forests of Rajpur-Soherin, 1904, by H. H. Haines.

axillary simple or paniced racemes 5-15" long. St. 10 monadelphous with sheath split above. Ovary linear long-stipitate 2-3-ovuled. Pod 1-3" very thin, but opaque and venous.

Frequent in Angul! and Puri districts! often in rocky places when it becomes bushy. Fl. April-June. Fr. April-June.

L. rhachis with short petiole 1-2.5" pubescent. Lfts. subsessile increasing in size from the base of the rhachis upwards, coriaceous polished above, finely sericeous partly or wholly glabrescent beneath, finely closely nerved, tip rounded rarely sub-acute. Rhachis of raceme densely rusty hirsute with 2 rows of minute sub-second bracts. Fls. sometimes subsolitary usually close but not fasciated. Calyx 12-2" campanulate rusty-pubescent, lobes oblong-rounded, two upper broader and shorter than the 3 lower. Standard retuse long-clawed and with two fleshy callosities. Wings oblong auricled. Keel petals connate above, all long-clawed. Filaments free above. Sheath open at base then connate anteriorly.

5. *D. tamarindifolia*, Roxb.

A large shrub scrambling or climbing by means of its recurved peduncles, singularly resembling a climbing Tamarind. Branchlets and leaf rhachis fulvous pubescent. L. 4-7" with 12-20 prs. of oblong leaflets 3-8" long, appressed fulvous-hairy beneath and less so or glabrescent above. Fls. white 25" in dense brown-pubescent shortly paniced racemes 5-2" long mostly from the leaf scars and on the new shoots. Pod linear oblong thin glabrous long-stipitate 1.5-3" long.

Ravines in the northern Rajmahal Hills, S.P.! Mayurbhanj, near streams above 2500 ft! Fl. Feb.-March. Fr. April-May. Partially deciduous in Feb.

Lfts. sub-sessile with oblique base somewhat gibbous on the upper edge, apex rounded or retuse. Calyx 12", lobes obtuse, ovate. Pet. long-clawed. Ovules 2-3. Pod 1-3-seeded.

My specimens were not in flower.

6. *D. volubilis*, Roxb. Nari siris, K., S.; Kalibeti, Nubari, Or.

A sarmentose and scandent shrub with long green branches, 7-13-foliolate leaves and pale purple or pale blue flowers in ample terminal panicles. Stamens in two bundles of 5 each. Pods oblong, 2-3.5" long by 6-75" broad, veined opposite the seed.

N. Champaran, common! Throughout the Central and Southern areas, along ravines and nalas! Fl. Feb.-March. Fr. May-June.

Attains 2 ft. girth in the Santal Parganas. Stem fluted. Wood with very large pores but without concentric bast rings. Leaves 3-10" long. Lfts. broadly oblong or obovate attaining 3-25" by 1.5" but usually only 75"-1.75" on flowering branches, very obtuse or emarginate, apiculate, nearly glabrous, petiolule .06". Inflorescence appressed pubescent or rusty tomentose with lateral branches 3-5" long. Fls. 25-3" pedicelled dense. Calyx tube campanulate, upper two teeth sub-orbicular, lower narrower acute. Seeds 1-2 light brown, 32" ellipsoid slightly reniform.

7. *D. paniculata*, Roxb. Sojanian-pati-tinia, Barahbakla, Or.;
Dhobin, Gond., H.; Sathpardia, Gond.?

A usually straight tall tree. Leaves with 7-15 alternate leaflets, 5-1.5" (rarely 1.75"), smaller orbicular or oval, larger oblong-elliptic or at end of rhachis somewhat obovate, beneath pale glaucous, minutely reticulate with somewhat raised nervules and nearly glabrous, above with sparse short appressed hairs. Fls. 28-3"

pinkish or bluish-white in dense very numerous mostly lateral panicles 2-3" long. Standard oblong with claw about one-third its length not of different texture and not thickened above it, two small lateral auricles sometimes present at base of blade. Pods 2-3" by .5-.62" tapering both ends, at base into a slender pedicel .2-.5" long. Seeds 1-3, brown smooth ellipsoid but sub-reniform at base.

In the Southern Tract only. Puri! Angul, common in cotton soil towards Khatada! Athmallik! Very common and grows to a large size in most of the Orissa States, Cooper! Fl. July with the leaves. Fr. Nov.-Jan.

Bark nearly white. Blaze as in next, from which it is sometimes difficult to distinguish in leaf. The tall straight habit is not invariable. The alternating bands of xylem and phloem serve to distinguish the stem and larger branches when cut. Lifts. with emarginate apex and usually rounded base, smaller than in the next. Calyx densely hairy, lower teeth subulate, upper linear-oblong sub-acute. The pod usually has a sharp terminal wedge with straight sides, whereas the terminal wedge in those of *D. lanceolaria* has often rounded sides and a blunt mucro.

The wood falls to pieces when sawn owing to the rings of phloem.

8. *D. lanceolaria*, L.f. Koiad, Kiachalom, K.; Chapot-siris, S.; Hardi, Kharw.; Lipsi (in Manbhum, teste Grieve); Chakundia, Sujanipati, Or.

A mod.-sized tree with leaves reaching a foot in length with 9-12 (or fewer on the smaller leaves) oblong, elliptic or obovate-oblong leaflets attaining 2.5" by 1.5" but often much smaller on the lower leaves of a branch, with about 12 very fine sec. n. and with thin scattered short hairs beneath, or on both surfaces when young. Fls. .3-.5" pink or purple or nearly white, sometimes tinged blue from a distance in dense or lax numerous lateral or terminal fulvous-pubescent panicles 2-4" long. Upper calyx lobes rounded or obtuse. Standard sub-orbicular above and sharply geniculate on the hardened subulate claw, usually white-margined and with green central callus; two small auricles at the base. Pod 2-4" by .5-.75", narrowed both ends, often sinuate between the 1-3 seeds with a stipes .3-.5" long.

Throughout the whole area, except perhaps in the north-east! Nowhere very common, usually in valleys or shady sides of hills and along streams. Fl. April-May when the tree is quite bare of leaves or with the young leaves. Fr. Sept.-Jan.

Bark white or grey nearly smooth, peeling off in oblong or irregular flakes. Blaze pale yellowish-white very soon darkening. Innovations yellow-silky. Stipules linear-oblong caducous. Lifts. with sometimes emarginate apex, base rounded, obtuse or sub-acute.

Var. *α lanceolaria* proper. Panicles and racemes lax. Fls. nearly .5". Calyx hairy with anterior lobe half to three-fourths the tube.

Var. *β*. Fls. secund in very dense racemes in panicles as dense as in last species. Fls. .3" only. Calyx densely hairy with anterior lobe as long as the tube. Santal Purganas!

A young forest of suckers springs up around this tree after the roots have been injured by trampling.

9. *D. spinosa*, Roeb.

A large woody climber or sub-erect, frequently with long sharp thorns bearing leaves and flowers, leaflets 5-9 usually 9, broadly elliptic or obovate .4-.7" long glabrous. Fls. very small in lax lateral racemes 1-1.5" long rarely shortly paniced. St. diadelphous in two

sets of 5 each. Pod somewhat kidney-shaped '8-1" long, 1-seeded rarely 2-seeded and then somewhat longer.

Tidal forests of the Mahanadi delta! Fl. April-May. Fr. July-Oct.

Attains 1 foot girth with rough bark. Branchlets sometimes circinate, glabrous. Fls. '12" long. Bracteoles caducous. Calyx glabrous campanulate about half the corolla, upper lobes rounded, lowest larger lanceolate. Standard obovate much exceeding the wings and keel. Ovary and pod stipitate.

55. PTEROCARPUS, L.

Large trees with alternate coriaceous exstipellate leaflets. Fls. yellow articulate on the pedicels, in paniced racemes with minute caducous bracts and bracteoles. Calyx turbinate, curved in bud, teeth short. Petals with long claws, standard and wings crisped. Stamens 5+5 or monadelphous with the sheath slit above only, or upper stamen free, anthers versatile. Ovary stipitate 2-ovuled. Pod orbicular with a broad wing, the apex displaced to near the base. Seed nearly always solitary.

1. *P. marsupium*, Roxb. Hid, K.; Murga, S.; Piasal, Bijasal, Paisar, H.; Bia, Kharw.

A handsome tree attaining large (7-10 ft.) girth. Leaves with 5-7 oblong or elliptic leaflets 3-5" long with rounded or obtuse or retuse ends, glaucous beneath; sec. nerves close parallel, over 12 each side. Fls. '5" in dense flowered racemes on terminal panicles 6-10" long and broad. Pod 1-1.75" diam. with stipes 2" long.

Not recorded from the Northern area. Common in the Central and Southern areas and apparently in all districts except in the plains. Very common in Patna and Kalandi States (Cooper). It thrives best on slopes near the nals in the hills esp. on north aspects. Common on quartzite in Sambalpur.

Fl. Oct. Fr. Dec.-Jan. Nearly evergreen, leaves renewed May-June.

Bark cinereous, rather rough. Blaze grey streaked, then pink and finely lined, with exudation of red juice (Kino).

Var. *acuminata*, Prain. Lfts. ovate, acute or acuminate. Pods larger than in the type.

Rajmahal Hills, Prain! It appears to be very rare.

P. marsupium is one of the best trees for planking in the province and it deserves to be largely planted. The supply is not at present adequate. The wood is largely used for furniture, implements, wheels, etc. As a pole it has not much value and should therefore always be allowed to reach timber size. The liquid gum Kino takes about a fortnight to harden. (A note on its preparation is given in *The Indian Forester* for August, 1899.) It is a valuable medicine in diarrhoea. The leaves are used for buffalo fodder and trees have been seen actually felled for this purpose of giving a meal or two to buffaloes in the so-called protected forests of the Santal Parganas! "The average weight is 55 lbs." Gamble.

Trees raised by me from seed at Chaibassa showed after 16 years an average height of 32 ft. and girth 17.4", but the locality is not favourable. Stools of Bija may be detected in the forest by their blackening from the exuding sap which is very rich in tannin.

56. DERRIS, Lour.

Trees or, always in our area, climbing shrubs. Leaves odd-pinnate with opposite leaflets, usually exstipulate exstipellate. Fls. small, solitary or usually fascicled on the rhachis on the branches of axillary or terminal racemes or panicles, bracts and bracteoles small and usually caducous. Calyx campanulate sub-truncate or with

Short teeth. Corolla exserted. Standard broad, not auricled, wings often spurred above the long claw, somewhat acuminate to the keel. Stamens usually monadelphous, but with upper filament free at base, rarely quite free, anthers versatile. Ovary sessile or shortly stipitate, few-ovuled. Pod usually thin, indehiscent, winged on one or both sutures, sometimes very narrowly. Seeds 1-few, reniform or orbicular.

Derris is in many respects closely allied to *Millettia* and except for the greater adhesion of the wings and keel the flowers are very similar.

- A. Fls. in clusters on the rhachis of simple or paniced racemes.
 Lfts. 1-2 prs. Racemes 1-4' not paniced 1. *uliginosa*.
 Lfts. 4-5 prs. oblanceolate. Racemes 1-4' paniced 2. *cuneifolia*.
 Lfts. 3-6 prs. lanceolate. Racemes 6-10' 3. *scandens*.
 B. Fls. not in racemes or clusters, copiously paniced:
 Lfts. 4-6 prs. oblong or ovate-oblong 4. *lariflora*.

1. *D. uliginosa*, Benth. Ketia, Or.

A large climbing shrub with brown branches marked with prominent white lenticels, leaves only 3-5-foliolate, leaflets ovate to oblong 1.5-3", or those on the 3-foliolate leaves sometimes 5" by 2.5". Fls. 4" long, white, 2-3-nate on a rhachis 5-7" long, which is occasionally branched and bears 1-2 leaves. Pod orbicular, 1-1.3" diam., with a very narrow wing on the upper suture.

Near the sea from Cuttack tidal forests! to Puri (near the Chilka Lake)!

Fl., Fr. April-June.

L. rhachis together with comparatively long petiole 3-6". Lfts. glabrous, base rounded, sec. n. 6-9 very fine, reticulate within the margin, nervules reticulate. Petiolule 2". Calyx campanulate nearly glabrous, teeth very short.

2. *D. cuneifolia*, Benth.

A large woody climber, the branches often tuberculate with the raised lenticels. Leaves large, 9-11-, rarely only 7-foliolate, with oblanceolate, oblong-obovate or narrowly elliptic glabrous leaflets which attain 7.5 by 3", but may only be 1.5 by .75" at the base of the rhachis. Racemes short lateral often appearing before the leaves. Fls. 4". Pod 2-3" by .5-6", sessile, venose, thin, flat, narrowly winged on the upper, very narrowly or scarcely winged on the lower suture, 1-3-seeded.

Bettiah Forests, N. Champaran! Santal Parganas, ravines near Banjhi! It also occurs in the Morung Forest of Nepal close to Purneah! Fl. April-May before or with the new leaves. Fr. Nov.-Jan. Deciduous.

Branches often long and whippy. Lfts. slightly ferruginous-pubescent when very young, soon glabrous, base rounded, tip tapering or not, sec. n. 8-10 slender finely reticulate between. Petiolules .25" blackish in mature leaves. Racemes 1-4' copiously paniced. Calyx .12" broadly campanulate glabrous except the densely pubescent rim.

3. *D. scandens*, Benth.

A large climbing shrub with brown lenticellate branchlets, and odd-pinnate leaves with 7-11 narrowly oblong, or few obovate-oblong or lanceolate leaflets .7-3" long coriaceous shining and glabrous. Fls. .3" white or pink in clusters along the brown-pubescent rhachis of



long racemes usually far exceeding the leaves. Pods narrow 1·3" and 1-seeded to 3-4" and 3-4-seeded, 4" wide with a very narrow wing down the upper sutures.

Orissa, wild; Cuttack! Puri! Often cultivated in gardens. Fl. July-Sept. Fr. Sept.-Feb.

Stems attain 9" girth with very large pores and rings of bast in the wood. L. rhachis very slender 1-4" (longer in some eastern specimens). Lifts. occasionally somewhat shortly sericeous beneath, usually somewhat tapering to an obtuse tip, sec. n. about 8 very slender and scarcely longer than the intermediate, finely reticulate between. Petiolules 1-15" slender pubescent. Racemes 3"-1 foot. Pedicels slender 2". Calyx subentire 1" sericeous. Pod sometimes repand on the lower or both sutures.

4. *D. laxiflora*, Haines.

A large woody climber with minutely rusty pubescent branchlets, 9-13-foliolate leaves with oblong or slightly ovate-oblong, rarely terminal somewhat obovate, leaflets 1-2 5" long, rusty pubescent beneath, and very thinly finely sericeous above. Flowers solitary, 35" long in axillary and terminal lanceolar rusty tomentose panicles 4-10" long. Ovary rusty-villous and young pod linear somewhat rusty pubescent. Pod oblong flat 2 by 7" narrowly winged on both sutures, sessile, 1-seeded.

Ramnagar Hills, N. Champaran! Fl. Aug.-Sept. Fr. Nov.-Dec.

The flowers were over in my specimens but remains were found in spiders' webs, the fruits mostly young. L. rhachis with petiole 2·5-6" rusty pubescent. Lifts. sub-coriaceous with rounded often oblique base and shortly rather suddenly tapering acute or obtuse tip, midrib very pubescent beneath, sec. n. 5-7 not strong, nervules obscure below very minutely reticulate above. Petiolules 1". Branches of panicle erecto-patent short 2-3". Bracts small persistent subulate. Pedicels 2". Calyx 07" long oblique truncate broader than long.

In leaf this plant resembles *D. scandens* except for the indumentum and fewer sec. n. but it differs wholly in panicle and fruit. It is most closely allied to *D. ferruginea* and *D. polystachya*, Bth., but the leaves of the latter are wholly glabrous and even the small-leaved forms of *D. ferruginea* have obovate leaflets and strong sec. n. The panicle of *D. ferruginea* has usually very long branches and fascicled flowers, moreover the young pod is much broader and very densely ferruginous hirsute. The inflorescence of *D. polystachya* resembles that of *D. ferruginea*.

57. PONGAMIA, Vent.

A tree with odd-pinnate leaves and opposite leaflets. Floral characters of *Derris*. Ovary sub-sessile 2-ovuled. Differs in the oblong pod, which is woody and not at all winged.

1. *P. glabra*, Vent. Karanj, H., K.; Kuruinj, S.; Darkaranja, Beng.; Kiramal, H.

Sometimes a large tree or sometimes, on the sea-coast, flowering as a shrub. Leaves 8-14" long with 5-7 shining oblong or ovate cuspidate leaflets 2-5" or sometimes up to 8" long. Flowers lilac, those near the coast of a deeper colour than inland, 2-4-nate in simple peduncled axillary racemes on pedicels 25-6" long. Calyx brown, corolla 5", standard silky. Pod woody glabrous 1-seeded, 1·5-2" long and 15-2" thick, with a short decurved point.

Indigenous throughout the greater part of the province along streams, and in the coastal forests. It is also found wild and of large girth (up to 5 ft.) on the top of the

Bhainsgot Hill (Puri) ! Abundant along rivers in Athmallik and other of the Orissa States. Largely planted in all districts. It is possibly not indigenous in the Northern Area. Fl. May-June. Fr. Dec.-Jan. Deciduous in May but renews its leaves the same month.

Bark smooth thin grey. Blaze shows chlorophyll under the outer bark, then thin yellow.

The pods are very largely collected for the valuable oil expressed from the seeds, which is largely used for burning and for the cure of skin diseases. It is also used in rheumatism.

A wonderful tree for adapting itself to diverse conditions, growing well with its roots in salt water, or fresh water, or exposed to the hot dry winds of Gaya and Chota Nagpur when planted along road-sides.

58. SOPHORA, L.

Trees or (in our area) shrubs with odd-pinnate leaves and showy yellow or purple, racemed or paniced flowers. Calyx oblique broadly campanulate with very short teeth. Standard broad, petals long-clawed. Stamens all free, or only obscurely connate at the very base, anthers versatile. Ovary stipitate, many-ovuled. Pod moniliform, indehiscent or dehiscent, joints turgid, sometimes winged.

1. *S. Bakeri*, *Clarke*. Bara Jirhul, *H.*; Moa Bodi, *Birja*.

A shrub 4-5 ft. high with tomentose shoots and leaves 5-8" long with about 7 prs. sub-opposite oblong silky leaflets, 1-1.25", or up to 2" long by .75" broad. Fls. purple in leaf-opposed racemes 4-6" long. Pod 3-4" moniliform, beaked, dehiscent, hairy.

Higher mountains and ridges in Singbhum ! Ranchi and Palamau, ascending to the tops of the pats, common at Neterhat 3000 ft. ! Parasnath ! Fl. May-June. Fr. Oct.-March.

Lfts. subsessile, mucronate, glabrescent above. Calyx purple pubescent .3-.4" long, two upper teeth connate rounded. Standard .5" with inflexed margins, deep-purple, notched. Wings narrow-oblong. Keel rather shorter, purple-veined, auricled. Stamens 9 very loosely cohering. Ovary and pod stipitate.

FAM. 54. CÆSALPINIACEÆ (Leguminosæ).

Trees or shrubs, rarely herbs. Leaves 1-2-pinnate, but sometimes leaflets only 2 and sometimes these two combined, thus simulating a simple palminerved leaf (usually 2-lobed) ; sometimes sensitive (showing sleep movements). Flowers large or small, zygomorphic or sub-regular, usually racemose. Calyx sometimes spathaceous, generally 5-merous and perigynous with a short or elongate tube (hypanthium), sepals imbricate or valvate. Petals 5, more rarely fewer or 0, free, imbricate, posterior innermost in bud and often different. Stamens normally 10, but some often reduced to staminodes or altogether abortive, inserted on the hypanthium, rarely connate. Ovary free or somewhat adnate on one side to the hypanthium, as in the Papilionaceæ, but more frequently indehiscent and samaroid in fruit and never breaking up into one-seeded joints.

The germination is generally epigeal or sub-epigeal, i.e., with the somewhat fleshy cotyledons elevated on a very short hypocotyl or hypocotyl suppressed.

- I. Leaves 1-pinnate or simple (of two connate leaflets).
 - A. Hypanthium very short.

Petals 5. L. several-foliolate	1. <i>Cassia</i> .
Petals 0. L. 6-foliolate	2. <i>Ceratonia</i> .
Petals 0. Leaflets 2 only	3. <i>Hardwickia</i> .
Petals 5. Leaflets usually combined into one	4. <i>Bauhinia</i> .
 - B. Hypanthium elongate.
 1. Petals 5-3.

Leaflets two usually combined into one leaf	4. <i>Bauhinia</i> .
Leaflets several. St. 9+1 (diadelphous)	5. <i>Amherstia</i> .
Leaflets many. St. 3	6. <i>Tamarindus</i> .
 2. Petals 0. Calyx petaloid. Lfts. several
 7. *Saraca*. |
- II. Leaves 2-pinnate.
 - A. Sepals valvate. Fls. 2-sexual.
 1. Unarmed trees with distinct rhachis to leaves.

Sepals petaloid, unequal, 4 upper connate	8. <i>Colvillea</i> .
Sepals subequal, green	9. <i>Poinciana</i> .
 2. Thorny small tree with very abbreviated rhachis
 10. *Parkinsonia*. |
 - B. Sepals sub-imbricate. Fls. polygamous.

Tree with copious branched thorns	11. <i>Gleditschia</i> .
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 - C. Sepals imbricate. Fls. 2-sexual.
 1. Ovary adnate at base to hypanthium.

Seed enclosed in the wing-like endocarp of the dehiscent pod	12. <i>Schizolobium</i> .
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 2. Ovary quite free from hypanthium.
 - a. Pod broadly winged, indehiscent.

Unarmed tree. Hypanthium shallow	13. <i>Peltophorum</i> .
Prickly climber. Hypanthium deep	14. <i>Mezoneuron</i> .
 - b. Pod not or scarcely winged, dehiscent or not.

Erect or climbing, often prickly	15. <i>Cesalpinia</i> .
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1. CASSIA, L.

Trees, shrubs or sometimes herbs with even-pinnate leaves and few or many leaflets. Flowers in axillary racemes and terminal panicles, rarely in axillary pairs. Calyx-tube very short. Petals subequal, usually somewhat zygomorphous. Stamens 10, frequently unequal or some reduced to staminodes, anthers dehiscing by a short slit or terminal pore. Ovary linear, many ovuled. Pod variable in shape, septate, dehiscent or not.

A large genus with many species found in gardens not here referred to. Many possess purgative properties. Senna Tea is the leaves of two species of *Cassia*.

- A. Trees, shrubs or herbs with broad obtuse sepals and large or mod. sized leaflets.
 - I. Trees. Stamens 10 antheriferous, 2-3 lower anthers different from the others. Pods indehiscent.
 1. Fls. in lax pendulous racemes, very large yellow
 1. *fistula*. | - 2. Fls. in erect corymbose racemes, red or pink.
 - a. Thorny. Lfts. oval 1-2" glabrescent. Fls. 1.5-2".
 2. *javanica*. | - b. Unarmed. Lfts. oblong or lanceolate-oblong.

Lfts. 2-3". Fls. 1.5-2.5"	3. <i>nodosa</i> .
Lfts. 8-15" pubescent. Fls. 1"	4. <i>marginata</i> .
 - II. Stamens 10, 4-7 only antheriferous (exc. *glauca*), 2-3 lower larger, 3-4 posterior reduced to staminodes. Pod dehiscent.
 1. Tree. Leaves without glands
 5. *siamea*. |

2. Shrubs or herbs. Rhachis or petiole with glands.
 - a. Rhachis usually with several glands between the leaflets.

Large shrub. All anthers perfect and sub-equal	6. <i>glauca</i> .
Large shrub. Stipules large semi-cordate. Lifts. 8-12 prs.	7. <i>auriculata</i> .
Undershrub. Lifts 3 prs. Glands 1-2 only	8. <i>tora</i> .
 - b. Gland only on top of petiole.

Lifts. 3-5 prs. more or less ovate	9. <i>occidentalis</i> .
Lifts. 6-12 prs. not at all ovate	10. <i>sophera</i> .
- B. Undershrubs or herbs with narrow acute sepals and (exc. *absus*) numerous very small sub-falcate leaflets.
 1. Lifts. mod.-sized only 2 prs. 11. *absus*.
 2. Lifts. small and many.
 - a. Petiole with a large sessile gland. Stamens 10 (-9)

Lifts. 20-40 prs. '3-6" long	12. <i>Leschenaultiana</i> .
Lifts. 40-70 prs. '15-2" long	13. <i>mimosoides</i> .
 - b. Petiole with a long stipitate gland.

Stamens 5. Fls. very small, under '2"	14. <i>pumila</i> .
Stamens 10. Fls. over '2"	15. <i>Kleinii</i> .

1. **C. fistula**, L. Hari, K., Mirju-baha, Nuruc', and the pod Bandarlari, S.; Danbar, Dhanrach, Kharw.; Sonarki, Uran; Sundaraj, Amaltas, H.; Sonari, Or.; The Indian Laburnum (but the true Laburnum is one of the Papilionaceæ).

A small or m.s. tree, very handsome in flower, with large, closely veined ovate, ovate-lanceolate or ovate-oblong acuminate or acute leaflets 2-7" long. Flowers 1.5-2.5" diam., light bright yellow in long pendulous racemes, succeeded by long cylindrical drooping pods 1-2 ft. long and 1" diam.

In all districts wild and planted. Indifferent as to soil and aspect, but never at all gregarious. Frequent on the Khurda laterite! Fl. May-Aug., but the pods may be found on the tree nearly all the year round and fall about April. Deciduous March-April.

Bark smooth pale or white. Blaze rather hard, red-brown slightly streaked. Lifts. 4-8 prs. with close strong sec. n. Racemes 1-2 ft. Pedicels long. Pods ultimately black, indehiscent with the flat transverse seeds embedded in flesh which is eaten by jackals, bears, etc.

The wood is hard, strong and heavy (about 60 lbs.) and much in demand for carts and agricultural implements. It is largely used for house posts for which it is well adapted as the tree does not grow to the size of large timber. It also gives a good firewood and charcoal, but the chief use of the tree lately has been for tanning bark, and in 1917-18 considerable leases were given out for its collection from the reserves, while Re 1/- per maund was paid for it in the Orissa States. It is said to be a good mixture with "tarwad." As the tree coppices readily and the poles are in demand, the sale of the bark for tanning is not as wasteful as it might seem. The flowers are eaten. Decoctions of the leaves and fruit are used as laxatives and the pulp round the seeds is the *Cassia pulpa* of the Brit. Pharmacopœia. It is made into a sherbert in Chota Nagpur. The seedlings at first are very slow growing. Gamble gives rate of growth as 9 rings per inch of radius.

2. **C. javanica**, L. Syn. *C. bacillus*, Gaertn. (F.I.).

A small tree with grey or brown bark, often thorny. Branches numerous spreading often flexuous with bifarious leaves about a foot long bearing 10-16 pairs of oval leaflets 1-2" long with very obtuse rounded or emarginate sometimes apiculate tip. Very handsome in flower with bright rose or pink flowers, 1.5-2" diam in elongating bracteate corymbs 4-6" broad. Pod like that of *C. fistula*, 18-24" long, flesh dry not pulpy.



Common in gardens. Fl. chiefly in the hot season.

Youngest branches and leaf rhachis thinly tomentose. Stipules lunate caducous, lower horn lanceolate, upper horn broader rounded or emarginate. Lfts. often few near the raceme, somewhat pubescent when young. Racemes terminal and axillary. Bracts lanceolate stipulate (cordate *Roxb.*). Sepals ovate, reddish.

Following the usual custom I take *Roxb.*'s *C. bacillus* to be the Linnean *C. javanica*, but the description of the latter in the *Species Plantarum* might as well be one of the following, and it is given as a native of India, whereas our species is a native of Java and the Malay Peninsula.

3. *C. nodosa*, *Ham.*

A small tree with spreading and weeping branches and bifarious leaves about a foot long (9-15") with 11-14 pairs of oblong or somewhat lanceolate oblong leaflets 2-3" long, but sometimes much smaller towards the base of the rhachis, chiefly distinguishable from the last by being somewhat narrowed and obtuse, acute, or very shortly acuminate at the tip. Equally handsome in flower, with pink or rose flowers 1.5-2.5" diam. in elongate bracteate corymbs which are usually lateral on branchlets other than the new ones. Pod similar.

Often cultivated in our area (*e.g. Ranchi*)! Fl. most of the rainy season. It is a native of India.

Young branches downy. Leaf rhachis pubescent when young. Stipules 5-8" lunate with both horns cuspidate. Lfts. puberulous beneath, base slightly unequal, sec. n. about 14. Bracts subsistent reddish ovate-lanceolate acuminate 3". Fls. very sweet-scented. Pedicels red 1.5-2" long. Sepals red 2". St. anterior 3 long declinate with a bulbous swelling on the yellow filament and fertile hairy anthers, 4 shorter arched with spurs opening by pores, nearly glabrous. Three apparently unfertile shorter with incurved filaments. Ovary hairy.

4. *C. marginata*, *Roxb.* Syn. *C. Roxburghii*, *DC.*; *C. javanica*, *F.C.N.*

A low tree with long spreading and weeping branches, tomentose branchlets and bifarious leaves 6-10" long with 8-20 prs. of oblong unequal-sided leaflets 8-1.5" long with rounded or emarginate and apiculate tip. Easily distinguished from the preceding two by the young leaves being densely yellow pubescent and the old ones silky below minutely pubescent above. Fls. deep rose-red only about 1" diam. in axillary and terminal corymbose racemes on the current year's shoots. Pod 8-12" long, often curved, flesh spongy.

Cultivated only in our area (*e.g. Dumka*)! Fl. Nov.-Dec. Native of India.

5. *C. siamea*, *Lamk.* Sometimes called *Siris* in Chota Nagpur and Chakundi in Orissa, neither name properly belonging to it.

A mod.-sized tree with leaves 6-12" long, 6-14 prs. of oblong leaflets 1.5-2.5" long and numerous very large erect or inclined panicles of bright yellow flowers. Pods flat 6-9" long, many-seeded.

Not indigenous but very commonly planted and self-sown. Fl. Sept.-Dec. Evergreen.

Lfts. emarginate with a small bristle from sinus. Panicle composed of numerous corymbose racemes.

A very rapid grower attaining 20 ft. in 2-3 yrs. in Singbhum, but short-lived, and very little else will grow in its vicinity. The heart-wood is deep-brown but useless.

6. *C. glauca*, *Lamk.*

A handsome shrub or small tree. Leaves with 4-6 prs. of ovate glaucous leaflets 1.5-4" long, usually with glands between the

leaflets. Flowers bright yellow in axillary corymbs with reflexed bracts. Stamens 10 with anthers similar but two lower filaments longer. Pod flat and thin 6-8" long.

Frequent in gardens! Campbell gives Manbhum as a locality with the Santali name of Bheda-dereng and says that the root is given in epilepsy. The plant was, no doubt, only cultivated.

7. *C. auriculata*, L. Tarwad, Vern.

A much-branched handsome shrub 3-10 ft. high with hairy twigs and leaves, 8-12 prs. of elliptic obtuse mucronate hairy leaflets 6-1" long, and large yellow flowers in subterminal corymbs. Easily recognised by the large broad foliaceous obliquely cordate stipules on the younger leaves. Pods 3-5" long by 7" broad, flat, obtuse each end. Seeds 6-10.

It is not indigenous in our area but has been recently sown in several divisions on account of the scarcity of good tanning material during the war. In the Central Provinces it flowered Oct.-Jan. and fruited Jan.-March and was partial to cotton soil.

Fresh tarwad bark contains over 20 per cent. of tannin. Mr. Fraymouth, Director, Esociet Tannin Research Factory, Maihar, said before the Tannin Conference at Dehra Dun in 1917 that the leather-making properties of this bark are quite exceptional, and "I doubt if any other tan-stuff can be found to provide a complete substitute for *tarwad*."

I found the plant very easily grown from seed at Nagpur and it attained 4-5 ft. and flowered in the first year, on cotton soil.

8. *C. tora*, L. Inc. *C. obtusifolia*, L. Syn. *Senna toroides*, Roxb.; Jomaikain, K.; Bheda-deren, chakoara, S.; Chekor, Kharu.; Chakunda, H.

An erect herb 1-5 ft. high with 3 prs. of obovate obtuse rounded or refuse leaflets, the pairs increasing in size from the base of the rachis upwards. Fls. 5" diam. axillary paired or solitary. Pods sub-terete or 4-angled very slender, falcate, 6-12" long, incompletely septate with numerous brown oblong seeds 12" long.

Very common and sub-gregarious in waste ground in the rains, but also found in forest glades where it attains 5 ft. in height! Fl. Sept.-Oct. Fr. Nov.-Dec. Annual.

Lfts. 1-2.5" long, glabrous or thinly villous with a linear gland between the lowest or two lower pairs, sub-sessile or shortly petioluled, odour usually fetid. Stipules setaceous. Fls. usually two on a very short peduncle but one often abortive.

Var. *obtusifolia*, Syn. *Senna toroides*, Roxb.

Roxburgh describes this as a more robust plant than *C. tora* with a single subulate gland only. Fls. larger, one always abortive and with little or no smell.

In our area at least the plants pass into one another, the large robust form in the Betlah forest having two glands, and I have actually grown plants with leaves fetid and glaucous beneath and only bearing one gland except on the lowest one or two leaves, which had two. Such plants may also be discovered in the wild state.

The young leaves (Chakaoda ara, K.) and the pods are eaten. Both leaves and seeds contain chrysophanic acid and therefore constitute a valuable remedy in ringworm and itch. The leaves are gently aperient (Nadkarni).

9. *C. occidentalis*, L. Kaiu, K.; Kasondi, H.; Kalakashunda, Beng. Sometimes called *Negro Coffee* in English from the roasted and ground seeds having been used as a substitute for coffee.

An erect stout herb, or suffruticose, 2-4 ft. high with leaves 6-12"



long with about 4-5 prs. of ovate or ovate-oblong or ovate-lanceolate lfts. 1.5-4" long. Flowers yellow .5-.75" diam. rarely sub-solitary, usually in axillary and terminal racemes, sometimes paniced. Pod 4-5" long, flattened, slightly falcate, septate between the numerous seeds.

A very common weed on waste ground during the rains. Fl. Sept.-Nov. Fr. Dec.-Jan. Annual.

Whole plant fetid. Stems often grooved. Petiole with a large tumid gland above its base. Lfts. sometimes lanceolate and acuminate. Stipules semi-ovate acuminate caducous. Axillary racemes very short, terminal many-flowered.

The leaves, roots and seeds are purgative and are said to be useful in cough and whooping-cough. The plant is also used for skin diseases in the same way as the last.

10. *C. sophora*, L. Bas-ki-kasunda, H.

A shrub 4-7 ft. high, stouter than the last, and the leaves with 6-12 prs. of lanceolate or narrow-lanceolate finely acute or acuminate leaflets mostly 1-3" long. Fls. 1-1.5" diam. in short axillary and terminal panicles. Pod sub-terete or terete 2.5-3", straight or very slightly curved. Seeds very many compressed.

All districts but not nearly as common as *C. occidentalis* and usually in hedges near villages. Fl. Aug.-Dec. Fr. Nov.-Dec., but also found in flower and fruit sometimes March and April.

This also has a single gland just above the petiole, but it is subulate, not tumid.

The properties and uses are practically the same as in the last two and an infusion of the bark or powdered seeds is said to be good for diabetes. An infusion of the leaves is given in rheumatic fever and as an anthelmintic and as an injection in gonorrhœa (*Nadkarni*).

11. *C. absus*, L.

An erect viscous-hairy herb 9-18" high with only two prs. of ovate or rhombic-ovate leaflets .6-9" long and terminal racemes of small yellow or red flowers with only 4 stamens, all perfect. Pod flat hairy 1-1.5" long, seeds black shining.

Chota Nagpur! Frequent. Probably in all districts. In somewhat open stony jungles and waste ground. Fl., Fr. Aug.-Oct.

Petiole 1-2". Stipules acicular hairy. Racemes 1-2" long.

12. *C. Leschenaultiana*, DC.

A slender erect but stouter plant than *C. mimosoides* with slender branches and leaf rhachis clothed with straight spreading hairs. Leaves 1.5-4" long with distinct petiole bearing a sessile gland. Leaflets 20-40 prs., .3-6" long. Flowers on long pedicels, two or more, rarely solitary on a very short extra-axillary peduncle clothed with pairs of stipule-like bracts. Sepals subulate, sub-aristate acuminate. Stamens 10 perfect or only 8-9, 4 anthers usually larger .16-2" long. Pod 1-2" long, linear-oblong, flat, hairy, about 15-seeded.

Purneah! Ranchi and Palamau, elev. 3000 ft. in damp places! Fl. Aug.-Sept. Fr. Oct.

Stipules lanceolate-acuminate with sub-oblique or semi-cordate many nerved base. Lfts. linear sub-falcate sub-aristulate. Buds ovoid long-beaked with the tips of the sepals. Sepals subulate, .45" long, hairy. Petals shorter. Seeds small pale-brown shining, oblong with oblique base.

13. *C. mimosoides*, L. Syn. *Senna tenella*, Roxb., also *S. sensitiva*, Roxb. ? Ot-kondro, S.

A slender erect or somewhat diffuse undershrub with many slender branches and leaf rhachides clothed with erect somewhat curled hairs. Leaves 2-3.5" with a very short petiole bearing a sessile gland. Leaflets very small and many, 50-70 prs., .16" long. Fls. solitary, rarely two, with very slender pedicels arising from a pair of extra-axillary bracts. Sepals .3" slender tapering both ends. Petals shorter. Stamens 10 perfect, 4-5 anthers distinctly larger than the others, the longer ones .12-.14". Pod 1-2", 15-25-seeded.

Usually in grass lands. Frequent in Chota Nagpur. Fl. Fr. r.s. Stipules .3" subulate with a filiform tip and a very broad sometimes sub-cordate base, strongly-nerved. Leaflets sensitive, closing up in the sleep position so that the leaf is only .045" wide, sub-falcate, mucronate. Bracts rarely two pairs on the very abbreviated sessile raceme; pair of bracteoles near top of pedicel about half as long as the sepals. Buds with appressed hairs, ovoid, beaked with the tips of the sepals.

14. *C. pumila*, Lamk. Ot-kondro, S.

A diffuse or prostrate herb with many stems 8-15" long, pubescent or sub-villous with curled hairs. Leaves very variable, .6-1.7" in smaller, 1-3.5" in the larger forms, with hairy rhachis, a long stipitate gland on the short petiole and sometimes one or more on the rhachis. Lfts. 6-25 prs. (sometimes on same plant), rapidly decreasing in size from the base to apex of rhachis, lower .2" long in the smaller, .5-.6" long in the larger forms, hairy or glabrous excepting the hispid margin, midrib produced into a short awn. Fls. very small, shortly pedicelled, 1-3 on a short bracteate extra-axillary peduncle. Sep. .12-.15", narrow, subaristate, 3 outer hairy on back, petals .1-.12". Anthers 5 about as long as filament. Pod flat, thinly villous or glabrescent, .8-1.2" with thickened sutures, 8-11-seeded.

Frequent in waste ground and pastures. Behar, Prain! Chota Nagpur! Santal Parganas, Gamble, Kurz! Fl., Fr. Sept.-Oct.

Stipules narrowly lanceolate, spinose tipped. Lfts. sub-falcate. Bracts on peduncle geminate subulate and two small bracteoles at apex of pedicels. Ovary densely villous.

15. *C. Kleinii*, W. & A.

Habit of *C. pumila* and indistinguishable without flowers. Leaflets more often nearly glabrous and nearly always over .1" long. Fls. much larger on a longer peduncle which often attains .7-8" in fruit. Sep. .2", three usually broadly-lanceolate, petals 2", anthers 10, 2-3-times as long as filament. Ovary usually only villous on the margins, style longer and less curved. Pod nearly straight erect or ascending 1.5-1.9" long, about 12-seeded.

Rare. Western Behar, Bengal Plants.

This may be merely a large-flowered variety of *C. pumila* in which the 10 stamens are correlated with the larger flowers, or (more probably) *C. pumila* is a variety of this species.

- Ceratonia siliqua*, L. Carob Tree; Locus; St. John's Bean.

A small or m.s. tree with a dense evergreen crown and even-pinnate leaves with usually 3 pairs of coriaceous elliptic rounded or retuse leaflets. Flowers small, polygamo-dioecious, in short spikes from the axils of fallen leaves with very small



condensed bracts and bracteoles. Hypanthium saucer-shaped with 5 small teeth, filled with a broadly peltate disc. Petals 0. Stamens 5. Ovary shortly stipitate, ovules many, stigma peltate. Pod linear-oblong, thickly coriaceous, indehiscent with thickened sutures and full of a sweet nutritious pulp, which is eaten raw, and forms in some of the Mediterranean countries an important cattle food.

The tree was grown some years ago in Hazaribagh and in Puri but I believe has not thrived. I have however no recent accounts of it.

3. HARDWICKIA, Roxb.

A tree with paripinnate leaves of only two palmately-nerved leaflets. Flowers very small numerous in paniced racemes. Calyx-tube very small, disc sub-basal. Sepals 5, rarely 4, oblong, imbricate, petaloid. Corolla 0. Stamens twice as many as sepals, alternate longer, anthers versatile. Ovary sessile, 2-ovuled. Pod samaroid, dry, apically dehiscent. Seed 1, apical, exalbuminous.

Germination epigeal but cotyledons usually raised but a short distance above the ground. Cotyledons rather fleshy, obconate-oblong, nearly 1" long, base with two small auricles indistinctly 3-4 nerved.

1. *H. binata*, Roxb. Anjan, H, Kharw.

A large and beautiful tree with drooping branchlets and glaucous foliage, the small leaves resembling those of a *Bauhinia* but with the two leaflets quite distinct, sessile, about 1-2" long, obliquely rhomboid or ovate obtuse 4-5-nerved. Fls. whitish in axillary and terminal panicles. Pod samaroid linear-oblong 2-3".

On sandstone in the Kymore Hills, formerly abundant and attaining 120 ft. in height (vide *Hooker*, Himalayan Journals); Palamau, near the Sone! Gregarious in patches. Fl. July-Aug. Fr. Feb.-March. Evergreen or nearly so; new shoots in April.

Attains 7-8 ft. girth but the forests not having been reserved large trees are now rarely found, though coppice shoots are frequent. Bark rough dark grey.

The wood is very hard and heavy, deep red and sometimes nearly black in colour. *Gamble* gives the weight as from 60 to 84 lbs. This extreme weight militates against its more extensive use for sleepers and construction. It is used for cart wheels and implements. The young trees are extensively lopped and mutilated for fodder and for the fibre of the bark. Although found on the Kymore sandstones it was common and easily grown on trap in the Central Provinces. The tree has to be sown in *situ* for artificial propagation.

Some useful sylvicultural notes by *L. S. Osmaston* will be found in the *Indian Forester* for June and July, 1909.

4. BAUHINIA, L.

Trees or shrubs, sometimes climbing by means of circinate tendrils, with two leaflets as in *Hardwickia* but usually connate into a broad palmately-nerved 2-lobed, rarely entire, simple leaf with rounded or cordate base and mid-rib (rhachis) ending in a bristle. Flowers usually large or m.s., rarely small, in simple or paniced sometimes corymbose racemes, rarely only 2-3 axillary. Hypanthium usually thickened and tubular or turbinate, calyx lobed or spathaceous. Corolla with clawed petals somewhat zygomorphic, the posterior, usually different from the others or sub-regular. Stamens normally 10, often reduced, occasionally only 1-3 perfect, anthers versatile. Ovary stipitate, stipes free or adnate to the side of the hypanthium. Pod linear to oblong, coriaceous or woody, dehiscent, rarely indehiscent, several or many-seeded. Seeds compressed, albuminous.

The germination in those species examined is sub-epigeal. The orbicular oblong sessile rather fleshy cotyledons turning green but lying close to the earth.

A. Erect trees or shrubs.

I. Fertile stamens 10. Calyx with short tube and spathaceous 5-toothed limb.

a. Small trees. Fls. rather small, not showy.

L. mostly under 2". Racemes simple with short pedicels 1. *racemosa*.

L. mostly over 2". Racemes sub-corymbose, lower pedicels long, far exceeding the bracts 2. *malabarica*.

b. Shrubs with showy white or yellow flowers.

Fls. 1-3 axillary usually yellow 3. *tomentosa*.

Fls. in short racemes, pure white 4. *acuminata*.

II. Fertile stamens 3-5. Calyx-tube elongate (exc. in *B. retusa*).

a. Leaves deeply lobed. Flowers large.

Fl. buds not angled. L. deciduous when flowering 5. *variegata*.

Fl. buds sharply angled. Fls. with leaves 6. *purpurea*.

b. Leaves scarcely lobed. Fls. small white 7. *retusa*.

B. Large climbers. Fertile stamens 3-5.

L. with rounded lobes. Fls. over 2" diam. 8. *VahlII*.

L. with acute or acuminate lobes. Fls. very small 9. *anguina*.

1. *B. racemosa*, Lamk. Kaimu, K.; Katmouli, Kathul, Kharw.; Ghatouli, Ur.; Ambalota, Or.; Kathal, Or. (fide Cooper).

A small tree with pubescent branches, small leaves broader than long, tomentose or pubescent especially on the nerves beneath and small whitish flowers in simple, not corymbose, tomentose racemes 2-3.5" long. Calyx spathaceous, petals linear oblanceolate. Pod 4-7" rarely 10" long, thick, sometimes slightly torulose, septate, not beaked or with very short beak under .2".

Central and Southern tracts. Usually in the dryer mixed forests! Manbhum! Hazaribagh! Ranchi, on the Ghats! Palamau, Betlah forest, frequent! S.P.! Athmalik! Puri, Baruni Hill! Angul, towards Khatada! Sambalpur! Cooper says common in the Orissa States. Fl. April-June. Fr. Nov.-Feb., but persisting till April. Evergreen.

Bark dark rough grey with dark-pink blaze. Leaves 1-1.5" by 1.5-2.5" pale glaucous beneath, lobed one-third way down, lobes obtuse, base shallow-cordate 7-9-nerved. Bracts linear-subulate about as long as pedicels. Corolla scarcely exsert, anthers densely villous. Seeds .12".

The pod is variable. A very thick form occurs on sandstone and conglomerate but there is also a fulcate less turgid variety. The wood is only used for fuel. The bark yields a fibre.

2. *B. malabarica*, Roxb. Laba, K.; Jhinjit, S.; Koinar, Turia; Sahul, Th.; Koteli, Or.; Ampti, H.

A small tree attaining 4 ft. girth with a bushy crown and dark green leaves 1-4" diam. broader than long, glabrescent and grey beneath. Fls. sub-regular whitish on slender pedicels in tomentose sub-corymbose racemes 2-3" long which are mostly in a corymbose panicle. Pod 7-12" by about .75" flattened, mostly curved, rostrate.

Usually a tree of moist localities and in the dryer districts loving the vicinity of streams. Throughout the whole province. Bettiah Forests, Champaran! Santal P.! Singbhum, on northern slopes and along valleys, frequent! Manbhum! Hazaribagh (Parasnath, etc.)! Puri! Angul! Sambalpur, frequent! Fl. Sept.-Nov. Fr. Jan.-March. Evergreen.

Bark light brown-grey nearly smooth or with linear-oblong flakes when old. Blaze hard pinkish red and pink turning red, or bright deep crimson in old trees. Shoots pubescent or tomentose. L. lobed one-eighth to one-quarter way down, sometimes permanently minutely pubescent beneath, base cordate, 7-11-nerved, petiole 1-2" usually black at the thickened tip. Calyx .25-.5", limb shortly 5-lobed.

petals slightly exserted, oblong-spathulate. Pod usually described as reticulato-venose, but this only appears when dry.

The wood is only used for fuel. The leaves have a pleasantly acid taste which may be used to discriminate this species from the last when only foliage is available and there is any doubt.

3. *B. tomentosa*, L.

A handsome shrub with young parts tomentose, 7-9-nerved leaves 2-3' long, rather broader than long, lobed less than half way down into two obtuse lobes, laxly pubescent beneath. Fls. yellow or white, shortly bluntly beaked in bud, in axillary or leaf-opposed peduncled pairs with linear bracts and bracteoles. Calyx spathaceous 5'', corolla 2''. Pod brown 4-5' long by .5''.

Frequently cultivated in gardens! Wood cites Tamar, 500-1000 ft., as a locality, without remark. Fl. July-Aug. Fr. Jan.-Feb.

4. *B. acuminata*, L. Ahalad, S.

A large shrub 6-15 ft. high with shoots curly pubescent, not tomentose, 7-11-nerved leaves often small 1.5-2.5 but in favourable situations attaining nearly 6' long and broad with petiole 1.5'', lobed over one-third to half way down into two acute or acuminate lobes, sparsely pubescent beneath. Flowers pure white well characterised by the long-beaked buds and long acuminate or beaked spathaceous calyx. Pod 4-5' by .7' beaked, widest above and tapering downwards, about 7-seeded.

Wild in the Santal Parganas, in cool places on Trap rock on the north side of Kandeshari Pahar! Wild on the Baruni Hill, Khurda! Very frequently cultivated in gardens! Fl. May-Aug. Fr. Jan.-April. Nearly evergreen.

The flowers are in short racemes 1-3' long with a pure white corolla 2.5-3' diam. The buds have beaks .5' long.

5. *B. variegata*, L. Buj, Juruju, Burunga, K.; Jantai, M.; Jhinjir, S.; Kachnar, H.; Kandol, *Bhumij.*; Lalkangchan (the red), Vagakangchan (the white), Beng.

A small or m.s. tree with 13-15-nerved leaves 2.5-6' by 3-6.5'', lobed about one-fourth to one-third the way down into rounded lobes, grey-glaucous and pubescent especially on the nerves beneath. Flowers large pure white or pink or purple with one petal variegated yellow, in short racemes mostly from leafless axils, flower buds terete. Pod 6-12' by .75-1' flat, dehiscent.

Naturally a tree of dry rocky hills and very beautiful in the forest. Chota Nagpur, all districts! Santal Parganas, Rajmahal Hills, occasional! Probably in all the hill districts of the Central and Southern Areas. Often cultivated in gardens and will sometimes flower in its second year as a shrub. Fl. Feb.-March, the upper part of the tree being more or less leafless at the time. Fr. April-May.

Bark grey longitudinally cracked, blaze pale pink or flesh-coloured darkening on exposure. Primary nerves sometimes only 11. Petiole .5-1.75 pubescent stout. Calyx spathaceous, tube 1-1.25'', limb broad ovate. Petals obovate 2-2.5' long. Perfect stamens usually 5 without staminodes. Pod very venose when dry and mature, papillose when young, stipes 1' long.

The wood is only used for fuel. The bark yields a fibre and is both eaten and used medicinally, Campbell. The flowers and flower-buds are sometimes eaten. Nadkarni says that the bark is astringent, tonic and alterative, and a decoction is useful in diarrhoea. The flowers are laxative. The dried buds are also useful in diarrhoea and worms, and a decoction of the root is an anti-fat remedy.

6. *B. purpurea*, L. Koilara, Th.; Sing-ara, M.; Sil-g-a, Ho.; Sinhara, S.; Koinar, Kharw.; Kundrau, Mal P.; Sona, H.; Deva-kanchan, Beng.

A m.s. tree but not infrequently flowering as a shrub, with 9-11-nerved very deeply lobed often oblong leaves 5-7" long, lobes with usually angular tips. Fls. large purple in terminal panicked racemes with *acutely* 5-angled flower-buds. Pod 6-12" by 75-1" narrow below, nearly always somewhat broadening upwards, flat, dehiscent when ripe with thin coriaceous twisted valves.

Frequent in all districts, especially in valleys and often grown in the villages. Fl. Sept.-Dec. Fr. Jan.-March.

Twigs glabrous. Bark ashy or dark brown, blaze with or without a pink outer layer, then pale yellow rapidly darkening, then nearly white but centre (on wood) again yellowish. Twigs glabrous. Leaves split from one-third of the way down often to near the base, glabrous or minutely puberulous on the nerves beneath, green, scarcely glaucous and much more membranous than in *B. variegata*. As in other *Bauhinias* very small leaves are sometimes present on same shoot with others. Petiole 1-1.5". Calyx spathaceous, limb .75", the turbinate tube .25-.3" only. Petals oblanceolate 1.25-2" long, often variegated, long-clawed. Stamens 3-2 perfect and staminodes filamentous.

The bark gives a fibre. The leaves are eaten as vegetables (a., ara, K.). The tree is frost hardy.

Var. *a triandra*, Roxb. (sp.).

A smaller-flowered form with pink flowers with a dark crimson centre. The leaves are also broader with a broader sinus, petals cuneate obtuse.

On limestone, Naga Untari (Palaman)! Fl. Nov.-Dec.

This is probably Roxburgh's *B. triandra*.

7. *B. retusa*, Ham. Laba, K.; Birnju, Bunju, Jhinjit, S.; Kaamaun, Katmauli, Kharw.; Tewa, Ur.; Kanla, H.; Choari, Or.; Panki, Khond.

A m.s. tree with entire or only slightly emarginate 7-11-nerved leaves 4-7", rather broader than long with a cordate or straight base. Flowers only 1" diam. zygomorphic, white with the three upper petals purple-mottled, in corymbose racemes arranged in ample terminal panicles. Pods straight, sub-oblong but rather broader upwards, 5-7" by 1.25-1.75" thin and deep red till ripe.

Hill districts of the Central and Southern tracts. Especially common on northern slopes in Chota Nagpur! Common in Angul, Mayurbhanj and Sambalpur in valleys and on quartzite hills. Fl. Sept.-Dec. Fr. Feb.-March. Evergreen.

Bark dark grey-brown, blaze very pale pink. L. green beneath easily distinguished by the entire or scarcely divided apex. Calyx-tube scarcely any. Petals subrhomboid above the long claws. Stamens 3.

The bark yields a fibre and gum, the latter used in sweatments. Campbell says that the leaves have a bitter disagreeable taste. The tree is frost hardy. The stem above the cotyledons is remarkably long and slender up to the first pair of foliage leaves which are opposite!

8. *B. VahlII*, W. & A. Maulan, Th.; Maholan, Kharw.; Maljan, Mahul, H.; Jom-lar, Lamak' lar, S.; Sialpatta, Or.

An immense climber with villosely tomentose shoots and young parts, simple circinate tendrils mostly leaf-opposed, deeply 2-lobed deeply cordate leaves from 2" to 18" diam. and corymbs of large

white or cream-coloured flowers. Pod woody 6-12" by 1.5-2", flat, velvety.

Throughout the province but especially on the hills and in stony ravines. Fl. April-June. Fr. Dec.-March. Sub-deciduous and renews its leaves in May.

The stem attains 2-4 ft. girth, often deeply fluted with nearly smooth brown bark. Leaves with rounded lobes more or less pubescent or hairy and with a very stout point from the sines. Corymbs often paniced, villously tomentose. Petals 1-1.5" densely villous on the back.

One of the most destructive climbers in the province but fortunately of considerable value. The bark yields a strong fibre (chop, *K.*; lamaklar, *S.*) used for ropes. The leaves are used as plates (*kalu, K.*) and cups (*pu, K.*). The pods are known as *lama* in *Kol*, in *Santal* the small-seeded variety being *cihri lamak*, and the large-seeded variety *dhalka lamak*. These pods are opened by means of heat which, to avoid carriage of the husks, is often applied inside the forest and is a fruitful source of forest fires. The seeds are an important article of food. The bark contains a quantity of tannin, but the mucilage makes its extraction difficult.

9. *B. anguina*, Roxb.

A woody cirrhose climber with peculiar compressed stems alternately convex and concave on the flexures. Branchlets very smooth terete. L. densely tomentose when young, adult thin glabrous 2-5" with two very long acuminate lobes or lobes short, and on old plants leaves often quite entire rounded and cuspidate. Fls. very small white .2-.25" diam. racemed in lax terminal pubescent panicles. Pod 1-1.8" long ellipsoid 1-2-seeded glabrous.

Ramnagar Hills, N. Champaran! Fl. Oct. Fr. Feb.-March.

Tendrils persistent simple or with two very symmetrically opposed coils. L. 7-11-nerved often as broad as long. Racemes long and slender. Calyx 5-toothed. Pet. obovate. St. 3. Ovary glabrous, stipitate.

5. AMHERSTIA, Wall.

Amherstia nobilis, Wall., is a well-known garden tree in the more humid parts (e.g. Cuttack). It has a broad dark green but low crown of large even pinnate leaves and long acuminate leaflets. The flowers are very large and showy in long pendulous racemes on long pedicels which have a pair of bright scarlet bracteoles at their apex. Sepals 4. Petals only 3 developed, the upper very broad 2" long and broad scarlet and yellow with a long tube, lateral wing-like narrower. Fl. May-June.

6. TAMARINDUS, L. Tamarind.

1. *T. indica*, L. Jojo, *K.*; Jojos, *S.*; Amli, Inli, *H.*; Totul, Teutuli, Beng., Or.; Tetar, Kharw.

A very large and very handsome tree with even-pinnate leaves with 10-20 prs. of small close linear oblong leaflets about .5" long and small red and yellow flowers in lax racemes. Calyx-tube turbinate, sepals lanceolate, imbricate, two lowest connate. Corolla with only the three upper petals developed, two lower reduced to filamentous scales. Stamens only 3 developed, monadelphous below, the sheath bearing 3-4 bristles (staminodes), anthers large versatile. Ovary stipitate, stipes adnate to hypanthium. Pod curved linear, somewhat compressed thick with thin crustaceous epicarp and thick pulpy mesocarp, indehiscent.

Commonly grown in villages and sometimes found in the forest on old deserted village sites. Naturalised among granite rocks near Kuru, etc., and it would

probably become so elsewhere but it suffers much from fire. Fl. usually April-June (but also seen in flower in October). Fr. Dec.-Feb. Evergreen. Supposed to be native of Africa.

It is easily grown from seed. The young plants have persistent linear-lanceolate stipules 5" long, pubescent shoots and leaflets 75" long.

The tamarind must be of exceedingly ancient introduction and it has two Sanscrit names, Tintidi and Amlīka. The ripe fruit is regarded in native practice as refrigerant, digestive, carminative and laxative and useful in intoxication caused by alcohol or datura (*Materia Medica of the Hindus*). Hamilton speaks of the tree being very large and abundant among the ruins of Gaur.

7. SARACA, L.

Trees with even-pinnate glabrous coriaceous leaves. Inflorescence showy with coloured bracts and calyx, flowers in sessile corymbose lateral panicles. Hypanthium long cylindrical, sepals on the terminal disc, 4, oblong, resembling a zygomorphic corolla, the true corolla absent. Stamens 3-8 with long coloured filaments and versatile anthers. Ovary long-stipitate, many-ovuled. Pod flat dehiscent, coriaceous. Seeds exalbuminous.

1. *S. indica*, L. Husangid-ba, Usangid-ba, K.; Asoka, Beng.

A strikingly beautiful tree when in flower, with dense corymbs 3-4" broad of a brilliant orange-scarlet, each flower with scarlet exerted stamens. The flowers are well set off by the dark-green leaves of 3-6 pairs of large oblong or oblong-lanceolate acute or acuminate leaflets which attain 9" by 2.5".

Along streams in the Ramnagar Hills, Champaran! Valleys of Singbhum especially in the ravines of Porahat! Bolah Reserve, Keonjhar, Grieve! Mayurbhanj, elev. 3000 ft. along streams! Arang Reserve, Angul! Southern Range, Puri, frequent! Fl. March-April. Fr. Sept. and seeds germinate in Dec. Evergreen. New leaves in purple drooping clusters appear at intervals.

Rarely exceeding 30 ft. with a low dense crown. Leaves sub-sessile, leaflets on some leaves only 2-3" long and lanceolate. Corymbs often sub-terminal on short special branchlets together with a single leaf, bracts sub-persistent ascending short ovate-acuminate, ciliate, and bracteoles similar, coloured. Sepals 2.5-5", tube 1-1.3". Pod 6-8" by 1-1.6" slightly oblique both ends.

The tree is often cultivated. Roxburgh says "when in full blossom, I do not think the whole vegetable kingdom affords a more beautiful object." In my opinion, however, it requires to be seen in nature, along some woodland stream, to appear at its best.

8. COLVILLEA, Boj.

1. *C. racemosa*, Boj.

An ornamental tree occasionally seen in gardens, introduced from Madagascar (teste Taubert). It grows to a moderate size and has handsome 2-pinnate leaves with very small linear leaflets, bears large drooping dense sub-paniculate racemes of bright orange flowers in September. Rhachis of racemes thickened. Bracts coloured caducous. Hypanthium very short bulged, with 5 sepals, 4 more or less connate, the fifth and lowest free. Uppermost petal very broad, lowest narrow. Stamens 10 free declinate villous below. Ovary sub-sessile free. Pod elongate straight turgid dehiscent with several seeds.

9. POINCIANA, L.

Trees with ample 2-pinnate leaves and numerous small leaflets. Stipules small or well-developed. Flowers showy, orange or scarlet in terminal corymbs. Hypanthium very short. Sepals 5, large sub-equal. Petals 5 with the uppermost different from the others.



Stamens 10 free declinate villous at base. Ovary sessile many-ovuled. Stigma truncate ciliolate. Pod woody flat straight or curved finally dehiscent. Seeds transverse, oblong.

The *Flora of Madras* has abandoned the well-known name *Poinciana* on the grounds that the species (*Poinciana pulcherrima*) for which it was originally established by *Linnaeus* has since been transferred to *Cesalpinia* (vide *Kew Bulletin*, 1920). It appears to be open to doubt whether this necessitates a change in the genus *Poinciana* as since modified and amplified and no confusion can possibly arise by retaining the old name.

1. *P. regia*, *Boj.* Syn. *Delonix regia*, *Raf.*; Gul Mohur (often corrupted in English to Gold-mohur), *Vern.*; Flamboyant, *Fr.*

A beautiful and well-known tree with feathery 2-pinnate leaves. When not in flower distinguishable from the many other trees with feathery 2-pinnate foliage by the pectinate stipules with finely linear segments. Petals 2" long or more, orbicular with a very long claw, the 5th lined with red and orange. Pod 1-2 ft. long. The narrow oblong seeds have a bony testa and often take two years to germinate.

Common in Indian gardens. Fl. April-June.

2. *P. elata*, *L.* Syn. *Delonix elata*, *Gamble.* The yellow Gul-mohur.

A mod.-sized tree with larger leaflets and orange flowers. Bracts small simple. Pod only 6-8".

It is planted more in southern India and is rare in our area. Its native country is doubtful. *Roxburgh* says that it is native in Coromandel.

Fl. April-May.

10. PARKINSONIA, *L.*

Trees or shrubs with sharp thorns which represent the abbreviated axis of a 2-pinnate leaf, pinnae 2-4 relatively very long, with compressed rhachis and numerous very small leaflets. Stipules converted into prickles. Flowers yellow in lax axillary racemes. Calyx-tube short, sepals equal coriaceous. Petals 5, the uppermost broader than the rest. Stamens 10. Ovary shortly stipitate, with many ovules. Pod linear, unevenly turgid, indehiscent or tardily dehiscent. Seeds linear oblong, parallel with the axis.

1. *P. aculeata*, *L.* Bilaiti-kikar, *H.*

A small tree with 2-6 pinnae on the shortened main axis and stipular thorns recurved or absent. Lfts. numerous linear-oblong .25" or less or obsolete. Pod 1-few-seeded, acuminate or beaked, dry, moniliform, 3-6" long, tardily dehiscent. Seeds brown .3".

Apparently naturalised (from America) in various parts of the province on waste ground. Banks of the Sone, Palamau! On cotton soil, S.P.! Frequent on cotton soil, Balasore!

The seed germinates in July. The cotyledons are foliaceous oblong rounded .8". The first leaves are pinnate with the stipules reduced to small deciduous points.

11. GLEDITSCHIA, *L.*

Trees with the axillary branchlets often converted into branched thorns. Leaves abruptly pinnate or bipinnate, sometimes in the same species. Lfts. rather small. Flowers greenish in often paniced spikes, polygamous. Calyx with 3-5 sepals. Petals 3-5

1. GLEDITSCHIA.] 54. CÆSALPINIACEÆ.

without claws, imbricate. Stamens 6-10 free. Ovary in herm. fl. free with 2-many ovules, short style, stigma terminal pubescent above. Pod short or long compressed, indehiscent or tardily 2-valved. Seeds often surrounded by pulp.

1. *G. sinensis*, Lamk. Syn. *G. horrida*, Willd.; Dozhik, Vern.; The Honey-locust.

A tree armed with formidable thorns, leaflets ovate-elliptic obtuse. Pod elongate compressed.

Either this or the next are often seen planted on railway platforms.

2. *G. macracantha*, Desf. Syn. *G. ferox*, Desf.? Vern. as above.

Similar in habit. Leaflets lanceolate rigid, about 2" long crenate-dentate. Pod very pulpy within.

Both species are native of China. *G. sinensis* has been introduced into Europe and whether the Indian tree is the same requires further examination.

12. SCHIZOLOBIUM, Vog.

1. *Schizolobium excelsum*, Vog.

A tree rather frequent in the town of Ranchi, introduced from Brazil, and there known as *Bacurubu*. It is readily recognised by its tall slender stem with smooth bark bearing a crown of large rather feathery 2-pinnate leaves and large paniced racemes of yellow flowers in April. Hypanthium turbinate oblique with 5 sub-equal oblong-ovate sepals, calyx and ovary with black hairs. Petals long-clawed oval-rotund 5-7" long with wavy margin. Stamens 10 declinate, uniform. Ovary stipitate with the stipes partly fused on the upper side to the hypanthium. Pod compressed obovate, dehiscent. Seed 1 enclosed in the wing-like endocarp which separates from the epicarp.

13. PELTOPHORUM, Vogel.

Tall trees with evenly bipinnate leaves and showy yellow flowers in axillary and terminal paniced racemes. Flower as in *Mezoneuron* but hypanthium shallow and stigma broadly peltate. Pod compressed, indehiscent, thinner and winged towards both sutures. Seeds 1-3.

1. *P. ferrugineum*, Benth. Syn. *Cæsalpinia inermis*, Roeb.

A large handsome dark-foliaged tree with rusty tomentose shoots and rusty panicles of showy yellow flowers. Pod oblong, about 3.5 by 1" with the wing each side equal. Seeds usually 3, brown oblong 4" long.

Now frequently planted, thrives well especially in the Central Area and is often seen on railway platforms. Fl. r.s. Fr. Dec. Native of the Eastern Peninsula and Ceylon.

Leaves 6' to 1 ft. long, pinnae 16-20, 3-6" long. Lfts. 20-30, close oblong, 5-7.5". Pod closely longitudinally veined.

14. MEZONEURON, Desf.

Differs from *Cæsalpinia*, to which it is very closely allied, chiefly by the flat indehiscent pod broadly winged down the upper suture, also in a less degree by its very oblique and deep hypanthium with the very cucullate lowest sepal. The floral bracts are nearly or completely suppressed.



1. *M. cucullatum*, W. & A. Baganaha, Th.; Baghin janum, S.; Kokobotur, K.

A large woody glabrous shrub, scrambling or widely scandent by the numerous small black sharp prickles on branches and leaves. Leaves ample 2-pinnate with deep green shining ovate leaflets 1-3.5" long. Flowers bright yellow or orange articulate on their pedicels in numerous paniced racemes, often from the old wood. Pod 2-4" long, 1-seeded.

Northern Area, Champaran to Purneah! Central Area, in valleys, Singbhum, especially in the Saranda forests! Dalbhum, Gamble! Santal Parganas, along streams! Fl. Sept.-Feb. Fr. Feb.

Stems with large conical or oblong bosses tipped by a prickle, sometimes one foot in girth. Leaf rhachis 6-12". Pinnæ distant 2-5 prs. Lifts. 3-5 prs. ovate to narrow elliptic. Two anterior sepals and anterior petal produced into a slipper receiving the base of the anterior filaments. Ant. pet. fleshy purple folded, deeply 2-lobed, others and usually also calyx, pedicels and rhachis yellow. Stamens 5 longer and 5 shorter but one very long and one very short, inclined, anthers bright crimson.

15. CÆSALPINIA, L.

Trees or shrubs often scandent and usually armed with numerous prickles and with large abruptly 2-pinnate leaves and usually showy yellow or red flowers in axillary racemes, more rarely racemes terminal and paniced. Bracts present, at least when young. Calyx-lobes imbricate, the lowest much the largest and cucullate, tube very short. Petals spreading (or erecto-patent in *C. coriaria*), usually orbicular and clawed, the posterior smallest. Stamens 10 free declinate, filaments often woolly. Ovary few-ovuled. Pod various in form, dehiscent or not, not winged (a rudimentary wing is sometimes present).

- I. Trees or shrubs, not scandent. Not indigenous.
 - A. Unarmed tree. Flowers small whitish 1. *coriaria*.
 - B. Prickly, at least on young stems. Flowers showy.
 - Tree, prickles very few. Pinnæ and leaflets 10-15 prs. 2. *sappan*.
 - Large shrub. Pinnæ 6-9 prs. 3. *pulcherrima*.
- II. Scandent prickly shrubs.
 - A. Petals broad. Pods unarmed.
 - a. Lifts. 2-3 prs. on each pinna 4. *nuga*.
 - b. Lifts. 6-12 prs. on each pinna.
 - Lifts. '25-'3". Pod thick, sub-fleshy. 5. *digyna*.
 - Lifts. '5-'1". Pod dry 6. *septaria*.
 - B. Petals narrow. Pod echinate 7. *crista*.

1. *C. coriaria*, Willd. Divi-divi, American Sumach.

A small or m.s. tree with a dense low spreading crown and pretty 2-pinnate leaves with very numerous close-set leaflets 12-3" long. Pinnæ 13-17, 1-2" long. Fls. small whitish sweet-scented paniced. Pods spirally twisted.

Introduced from Central America and often cultivated for ornament, e. g. Chaibassa, Santal Parganas and Koderma! Fl. May-June. Fr. Aug. Evergreen. It was originally introduced for tanning purposes but does not seem to be used in the province. The seed germinates well in about a week after sowing but it is probably not worth growing on a large scale, other more easily accessible materials being as rich in tannin as the pods of Divi-divi.

2. *C. sappan*, L. Bakam, Beng.; Patang, H.

A small tree with small and few or sometimes no prickles. Pinnæ

8-12 prs. Leaflets close sessile 5-75" oblong oblique or falcate, 10-20 prs. Fls. yellow, the racemes paniced. Pod 3-4" by 1.5" wider and truncate at apex which is prominently beaked, polished, indehiscent. Seeds 3-4.

Planted at Ranchi and Hazaribagh! Fl. r.s.

The wood yields a red dye not, I believe, now used in the province. It is allied to the Logwood (*Hæmatoxylon campechianum*) of Central America, but the dye is Brasilin and in Logwood Hæmatoxylin. Before the advent of the aniline dyes *sappan* is said to have been much used as a dye for cotton fabrics. It is a powerful astringent (*Nadkarni*).

3. *C. pulcherrima*, Swartz. Krishnacharan, Gultorah, Vern.; Peacock flower; Barbadoes Pride. Syn. *Poinciana pulcherrima*, L.

A handsome much-branched shrub, but getting straggly and untidy when old. Upper branches often without thorns. Leaf rhachis smooth glossy 7-11" long with 6-9 prs. of pinnae. Lifts. on median pinnae about 8-10 prs., median about 7" long, glabrous, broadly oblong, emarginate and apiculate. Flowers scarlet or yellow in elongate axillary and terminal racemes 6-12" long or more in fruit. Pedicels 1-1.5" long articulate above. Petals, four sub-equal transversely oblong above the long claw 7", the fifth with its claw longer and blade smaller and much crisped. Filaments declinate 2" long, 5 longer than the others.

Very common in Indian gardens and sometimes running wild. Seeds sown in the r.s. will flower in the following c.s. and h.s.

The yellow variety is sometimes called var. *lutea*.

4. *C. nuga*, Ait. Syn. *C. paniculata*, Roxb.

A large prickly climber with prickles on the branches, at the base of the pinnae and along the rhachis of the leaves above. Pinnae 3 prs. Lifts. usually only 2 prs. on each pinna or one pair and an odd, elliptic- or ovate-lanceolate, shortly obtusely acuminate or acute, 7-1.5" rarely 2" long, coriaceous with very indistinct venation. Fls. yellow, fragrant in paniced racemes; calyx about 3" and petals not much exerted, filaments densely woolly below. Pod compressed woody, obliquely broadly elliptic sharply cuspidate, about 2" long only without the cusp and short stipes and 1.2-1.4" broad with one, very rarely two, large brown flattened ellipsoid seed.

Tidal Forests of Orissa! Fl. Jan.-April. Fr. May.

In the Himalayan Journals Sir J. D. Hooker, speaking of that part of the Grand Trunk Road not far from Parasnath, writes: "On the way I found the *C. paniculata*, a magnificent climber, festooning the trees with its dark glossy foliage and gorgeous racemes of orange blossoms." There is a doubt as to what this passage refers but I believe it to have been *Mezoneuron cucullata*, which in foliage much resembles *C. nuga*. It could scarcely have been *C. nuga*.

5. *C. digyna*, Rottl. Umul-kuchi, Beng.; Hainsa, Th.; Gilo, Or.; Tari, Or.? Tari appears to be the trade name of the pods. Teri in Assam.

A large much branched scrambling shrub copiously armed with recurved prickles. Leaf rhachis 5-8" or up to 11" long, with geminate prickles at each pair of pinnae, minutely pubescent or fulvous hairy. Pinnae 8-10 or up to 12 prs., 7.5-2.5" long, swollen at base. Lifts. 7-10 or up to 12 prs. on the median pinnae, 2.5-4" rarely 5" long,

close oblong. Fls bright pale yellow 7" diam. in copious supra-axillary glabrescent racemes 3-8" long, pedicels slender spreading, 7-1.25" with very oblique persistent spreading truncate calyx-tube, sepals lanceolate 2" and anterior 4", soon deciduous. Petals orbicular, posterior smaller reflexed. Pod 1-2" long, oblong thick fleshy shortly stipitate crowned by the long style, 1-4-seeded. Fruiting pedicels slender.

In the damper districts. Champaran, near streams in the Ramnagar Hills! Purneah and the northern Santal Parganas! Mayurbhanj! Bonai, Cooper! Puri, but not abundant! Angul, fairly common in places! Narsingpur! Fl. July-Oct. Fr. Feb.-April. Evergreen.

Usually very dense. Branches shining, lower prickles 5" straight and sharp, upper 1-2" recurved and those on leaf rhachis small. Lfts. pale beneath with rounded tip and sub-cordate oblique base, minutely appressed hairy beneath and puberulous above, becoming nearly glabrous with age. Racemes often curved, glabrescent, bracts almost obsolete. Filaments far exerted woolly below. Calyx glabrous. The young pod shows signs of a wing. Seeds roundish smooth dark brown 4-5" diam. with very hard testa.

The pods are said to contain as much tannin as the American Sumach and leaves have been asked for. The plant is, however, far more abundant towards Assam and Burmah.

Seed obtained from Burmah, sown in July, germinated at Sambalpur after 25 days (*Mudaliar*).

6. *C. sepiaria*, Roxb. Uri, Relu, Kando, H.; Gilo, Or.

An extensive shrub rambling or climbing by means of the recurved prickles on the stems and leaf rhachis. Branchlets and leaf rhachides and panicle rusty pubescent or sub-tomentose. Leaf rhachis about 12" long with geminate prickles between as well as at base of pinnae. Pinnae 5-10 prs., usually 1-2" apart, 3-5" long. Lfts. 6-12 prs., 5-1" long or some only 3" long, broadly oblong, close, rounded or retuse both ends, puberulous both sides or nearly glabrous above. Fls. showy bright sulphur yellow 7.5-9" diam. in long simple racemes 6-12" long which are terminal or in a vertical supra-axillary series of which the uppermost is the oldest. Pod oblong dry compressed 3-3.5" long tipped with the straight hardened style which is 5-7.5" long. Fruiting pedicels stout, woody.

Occasional. Gangpur, near the Brahmini river! Ranchi, planted not far from the Mahadeo Temple and occasional in gardens and hedges! Fl. Dec.-May. Fr. old ripe pods have been found by me both in September and June and unripe ones in February. I am not sure to which flowering months they relate as they remain long on the plant.

Branchlets sometimes 5-angled. Stipules semi-sagittate caducous. Young racemes with deciduous lanceolate recurved bracts 3" long. The small petal usually with red lines. Lower part of filaments densely woolly. Pod very tardily dehiscent.

7. *C. crista*, L. Syn. *C. Bonducella*, Fleming; Bagni, S.; Katkaranj, H.; Nata, Beng.; The Fever-nut.

An extensive climbing or scrambling shrub covered with short straight prickles, those on the leaf-rhachis reflexed. Branchlets fulvous-hairy. Leaves ample with large persistent compound or pinnatifid foliaceous stipules. Pinnae 6-8 prs. and leaflets about 8 prs. oblong or ovate-oblong 5-1" by 5". Fls. pale yellow 5 by 7.5" diam. in simple usually supra axillary very elongate racemes, the lower flowers only fertile. Young pods softly echinate, old broad-oblong prickly, 2-3" long, dehiscent, 1-2-seeded.

Usually in hedges in the open. Champaran! Gaya! Ranchi! Santal P., frequent! Puri! Sambalpur! Fl. Aug.-Oct. Fr. Dec.-April. Evergreen. Lfts. not contiguous, slightly downy beneath, with obtuse mucronate tip. Bracts long linear reflexed over the buds '6-75" long, deciduous. The small erect petal marked with orange. Seeds large round grey '75" diam. with an exceedingly hard testa.

The seeds, Putikaranja in Sanskrit and Natakaranja in Bengali, are said to resemble in properties those of *Pongamia* (Dutt). The seeds and the root bark are largely used as antiperiodic and febrifuge in fevers. Foxburgh says the seed is a powerful tonic; Nadkarni that the powdered seed acts as a tonic in dyspepsia, and that the same smoked in a hucqua is said to cure colic; other uses are also given in *Indian Plants and Drugs* by that author.

I have found the seed germinates more quickly if the testa is rasped. The germination is hypogeal.

FAM. 55. MIMOSACEÆ (Leguminosæ).

Trees or shrubs, rarely (*Mimosa pudica*) undershrubs, with 2-pinnate leaves (rarely main pinnae digitate). Pinnae and leaflets sometimes reduced to one pair or (in some exotic *Acaciæ*) absent and the rachis developed as a phyllode. Flowers small regular, collected into spikes or heads with usually prominent stamens but small perianth. Calyx tubular or campanulate, truncate or valvately toothed or lobed, sometimes minute. Petals valvate, free or more or less connate into a tubular or funnel-shaped corolla (gamopetalous) hypogynous or perigynous. Stamens as many or twice as many as the petals or numerous, hypogynous to perigynous, free or monadelphous sometime adnate to the base of the corolla. Ovary 1-carpellary free from the hypanthium, 2-many-ovuled. Fruit a dehiscent or indehiscent dry or sub-succulent pod, very rarely breaking up inside the sutures into one-seeded joints.

Germination in those species examined by me is epigeal in most, but sometimes hypogeal as in *Entada*. The first true leaves are often at once bi-pinnate.

I. Stamens definite, usually 10 (*Mimoseæ*).

A. Flowers spicate. Anthers apiculate with a small gland in bud.

- | | |
|---|---------------------------|
| Large climber with tendrils and immense pods | 1. <i>Entada</i> . |
| Unarmed tree with ample leaves | 2. <i>Adenanthera</i> . |
| Small thorny tree. Fls. polygamous, similar | 3. <i>Prosopis</i> . |
| Small thorny tree. Fls. dissimilar, spikes parti-coloured | 4. <i>Dichrostachys</i> . |

B. Flowers in globose or oblong ovoid heads.

- | | |
|---|---------------------|
| 1. Anthers apiculate glandular. Pinnae only 2 | 5. <i>Xylia</i> . |
| 2. Anthers not gland-tipped. Pinnae several. | |
| a. St. monadelphous. Sepals imbricate | 6. <i>Parkia</i> . |
| b. St. free. Sepals valvate. | |
| Unarmed. Pod not jointed | 7. <i>Leucæna</i> . |
| Prickly. Pod breaking into joints when ripe | 8. <i>Mimosa</i> . |

II. Stamens indefinite (*Acaciæ*).

A. Stamens free.

- | | |
|--|--------------------|
| Usually spiny or prickly trees or shrubs | 9. <i>Acacia</i> . |
|--|--------------------|

B. Stamens monadelphous. Usually unarmed trees.

- | | |
|---|----------------------------|
| Pod thin flat | 10. <i>Albizzia</i> . |
| Pod circinate, dry. Sometimes prickly trees | 11. <i>Pithecolobium</i> . |
| Pod straight, flattish, rather succulent | 12. <i>Enterolobium</i> . |

1. ENTADA, Adans. (*Pusaetha*, L.)

Woody, sometimes immense, climbers with 2-pinnate leaves, uppermost pinnae (or all in the seedling) sometimes converted into tendrils, leaflets often large and few-paired. Stipules small, bristle-like.

Flowers 5-merous small in slender single or fascicled spikes which are often paniced towards the ends of the leafless branches. Calyx campanulate, very shortly toothed. Petals free or slightly connate. St. 10 free, exserted. Ovary sub-sessile with many ovules. Pod compressed, in our species very large and woody, with thickened sutures and breaking up within them into large 1-seeded joints. Endocarp enclosing the seed and separating from the epicarp. Seeds large compressed exalbuminous.

1. *E. scandens*, Benth. Syn. *Pusaetha scandens*, L.; Karu, K.; Kari, Kharu.; Bidhanta, S.; Gila, Gilo, Beng., Or.; Osta, Arsi, Or. (teste Cooper); Saruni, Vern.

An immense woody climber with the 2-pinnate leaves usually ending in a point or two-fid tendril, pinnæ only two pairs often ending in an abortive leaflet. Lifts. 2-4 prs., terminal leaflet 2-3" long, others shorter towards the base of pinnæ. Spikes of green or cream-coloured fls 4-9" long, pubescent, often extra-axillary. Pod the largest of the family in India, often 2 ft. long, large chestnut-coloured seeds discoid 1.5-2" diam.

Throughout the area, but not common except in the damper high forests. Purneah! Santal P.! Singbhum, valleys! Palaman, Haslett! Mayurbhanj, elev. 3000 ft.! Puri Mals, common! Fl. April, Fr. March-May of the following year. Deciduous March-April.

Attains 3-4 ft. girth, stems often with cork-screw-like flanges. Bark brown, blaze red or pink and very fibrous in old stems, wood without the large pores usually common in climbers. Lifts narrow-elliptic to obovate, with many fine sec. n., apex emarginate even when shortly acuminate, above glossy. Calyx 12". Corolla lobes valvate 17", oblong-lanceolate acute. Bracts minute linear.

The powdered seed mixed with ghee is eaten as an anodyne during parturition. The seeds are often worked up into small boxes and ornaments.

The germination is hypogeal, and the seedling concentrates all its energy in quickly getting up through the bushes to the light so that all the leaves are entirely converted into slender tendrils, the rhachis ending in a mucro. These tendrils gyrate very fast, describing many complete circles in the course of the day.

2. ADENANTHERA.

1. *Adenanthera pavonina*, L. Ranjan, Rakto-kanchan, Beng.

A large handsome tree but sometimes flowering as a shrub is sometimes found in gardens, as at Danka and Ranchi. It has ample 2-pinnate leaves with 8-12 distant pinnæ, each with 12 or more alternate oblong leaflets 7.5-1.25" long. The flowers look somewhat like those of *Entada*, being small and yellowish in axillary and paniced spiciform racemes 2-6" long, each with 10 free stamens as long as the corolla. Pod 6-9" by 5" falcate, with about 10 bright scarlet, rarely yellow-brown seeds, each of which are said to weigh 4 grains, and are used as weights and ornaments.

3. PROSOPIS, L.

Trees usually with axillary or paired thorns or stipulary and scattered prickles, rarely unarmed, with evenly 2-pinnate leaves of a few pairs of pinnæ and many narrow coriaceous leaflets, glands often present on the rhachis. Fls small, in narrow spikes or spiciform racemes without bracts and bracteoles. Calyx campanulate with short teeth. Petals 5 ligulate connate to the middle or later free. Stamens 10 free, slightly exserted, anthers with an apical gland. A

raised disc sometimes present. Ovary stipitate, many-ovuled. Pod flat or turgid with a thick spongy mesocarp, septate, often torulose. Seeds ovoid, compressed.

1. *P. spicigera*, L. Jhand, H.; Shami, Beng.

A small thorny tree with rather glaucous foliage. Leaves with 2 prs. of pinnae only, each with 7-10 prs. of ligulate leaflets .25-.5" long with an ascending cusp. Spikes 2-3". Corolla under .1". Pod straight cylindric torulose, 4-8" long with 10-15 seeds.

A specimen in the Calcutta Herbarium is described as from "Bihar" but it is very rare there and probably only in the driest parts. In districts where the tree is abundant the pods form a valuable food for cattle, camels and goats.

4. *DICHROSTACHYS*, DC.

Small trees or shrubs with the branchlets often ending in thorns. L. 2-pinnate with several pinnae and many small or minute ligulate leaflets, stipules present, stipellæ 0. Spikes parti-coloured with dimorphous minute flowers, the upper yellow and 2-sexual, the lower pink and neuter bearing long filiform staminodes. Calyx minute. Corolla oblong with 5 ligulate petals connate towards the base. Stamens free, 10, anthers gland-tipped. Ovary many-ovuled. Pod narrow compressed becoming spiral or irregularly bent and depressed between the seeds, not septate.

1. *D. cinerea*, W. & A. Vurtuli, H.

A large branched shrub or small tree looking like an *Acacia* when not in flower. Twigs mostly ending in a thorn. Easily recognised by its pretty tassel-like stalked heads of flowers, the lower 1-2" with staminodes .5" long being a bright rose colour, the upper usually shorter portion yellow with the stamens more shortly exerted and antheriferous. Pods curled and twisted 3-4" long in clusters.

Only found on black cotton soil in the extreme south of the province! Puri! In flower or fruit most of the year round. Seed has been collected October and November.

Bark grey. The habit is very characteristic, the numerous branches being armed with short lateral and terminal straight thorns and the leaves on the thorns and small nodose tubercles which are covered with what are apparently the bases of persistent stipules. L. rhachis only 1.5-3" long pubescent with 3-12 prs. short pinnae and numerous leaflets only .05-.1" long. Seeds 6-10.

5. *XYLIA*, Benth.

Tree with 2-pinnate leaves; pinnae only one pair with large leaflets. Flowers small tubular-campanulate sessile in dense globose peduncled heads, often imperfect and 1-sexual, peduncles mostly from the axils of fallen leaves, and clustered on the new shoots before the leaves develop, often paired from the axils of caducous linear scales. Calyx with 5 lanceolate lobes. Petals 5 valvate. Stamens 9-10 free, exerted, with slender filaments, anthers apiculate and tipped with a caducous gland. Ovary sessile or reduced to a fulvous hairy pistillode. Ovules many. Pod large woody scarcely septate, seeds oblong compressed.

X. xylocarpa, Taub. Syn. *X. dolabriformis, Benth.*; *Inga xylocarpa, DC.*; Kongra, Or.; Suria, H.; Tangen, Khond (Kalahandi).

Usually a small tree in our province but attains 6 ft. girth in places, with brown tomentose thick branchlets. Petiole together with main rachis 2-5", sec. rachides 4-13" with normally 5-6 prs. of leaflets, rarely 2-3 or 7 prs. on some leaves, basal usually ovate upper oblong, length 2-8" with 7-12 fine oblique sec. n. Glands 4-5 on rachis, between the upper leaflets. Peduncles 1-2". Heads .5-.75 diam. (without the stamens). Corolla one and a half times as long as the calyx. Pods flat woody somewhat shoe-shaped, 6" long and 2" broad towards base and about 1.25" broad towards apex, the gibbous base contracted upward to the stipes. Seeds brown broad-oblong .5-6" about 10, in depressions of the valves.

Frequent and often kept as standards in the Puri forests! Mayurbhanj, up to 1000 ft., attaining large size! Kalahandi! Narsingpur, attains 6 ft. girth in the high valley of Nayagarh! Fl. April-May when leafless. Fr. Feb.-April.

It is the well-known Pyingado or Iron-wood of Burmah but the small trees as usually found do not appear to be of much value.

6. PARKIA, R. Br.

Large handsome trees with ample 2-pinnate leaves often with glands on the petiole, and very many small leaflets. Flowers in dense heads on long peduncles, each flower narrow-tubular subtended by a narrow bract with a clavate or spoon-shaped tip. Stamens 10 exserted, connate below, anthers eglandular. Ovary stipitate. Pod large flat narrow many-seeded.

1. *P. biglandulosa, W. & A.* The Drum-stick tree.

A very handsome tree with large feathery leaves 12-20" long, petiole with 2 glands. Heads of flowers with an offensive smell on long rusty peduncles 6" long, deep brown in bud and constricted about one-third way up. Fls. about .5" long.

Often planted, e.g. in forest compound at Chaibassa. Fl. Feb. The trees at Chaibassa averaged 54.5 ft. in height and girth 43.3" in 15 years. They are therefore remarkably quick-growing.

7. LEUCÆNA, Benth.

Trees, or flowering as large shrubs. L. 2-pinnate. Flowers in dense globose heads which are often fascicled or paniced. Stamens 10 free much exserted without gland-tips. Ovary stipitate. Pod flat coriaceous many-seeded.

1. *L. glauca, Benth.*

A large shrub or small tree. L. with 4-8 prs. of pinnae each with 10-15 prs. of linear glaucous lfts. .3-.5" long. Fls. white in heads 1" diam. Petals twice the calyx-tube. Pods about 6", very numerous, with flat transverse ovate seeds.

Commonly planted and often self-sown in moist situations. Fl. May-Aug.

8. MIMOSA, L.

More or less prickly shrubs or undershrubs with digitate-pinnate or 2-pinnate leaves and numerous small, more or less sensitive

leaflets, stipules and stipellæ small. Fls. very small in dense globose heads, mostly 4-merous. Calyx campanulate, teeth small. Stamens as many or twice as many as the petals, much exserted. Pod flat dry, breaking up into 1-seeded joints which separate from the continuous slender sutures.

- A. Pinne digitate. Stamens as many as petals 1. *pudica*.
B. Pinne pinnately arranged. Stamens diplostemonous.
1. Leaves much over 1" long.
Pinne 8-12 prs., lfts. 16-20 prs. '2-3" long 2. *himalayana*
Pinne 4-6 prs., lfts. 10-15 prs. '4-7" long 3. *rubicaulis*.
Pinne 5-7 prs., lfts. 7-8 prs. Pod sutures aculeate 4. *Prainiana*.
2. Leaves under 1" long.
Pinne 3-5 prs. Pod very prickly 5. *hamata*.

The Indian species of *Mimosa* have been revised by Gamble in *Kew Bulletin* No. 1, 1920. In this the species usually hitherto known as *M. rubicaulis* and *M. hamata* have been split up. My collections and those at Kew only show the new *M. himalayana* from our area but these are so few that I have added the typical *M. rubicaulis* and *M. Prainiana* to the Key in case they should hereafter be found, and also shown *M. hamata* for comparison.

1. *M. pudica*, L. Lajalu, lajwati, H.; Kajak, Beng.; Lajkuri, Or.;
The Sensitive Plant.

A well-known small undershrub with weakly-prickly stems and compound spreading long-petioled leaves, with 4 digitately arranged pinne 1-2.3" long, leaflets linear '3-4" rarely '5" long, stipules pectinately ciliate. Peduncles 1-2 axillary with pretty pink heads of flowers. Bracteoles to the male flowers minute subulate or 0, to the hermaphrodite flowers stiff subulate pectinate. Fls. '03" long without the stamens which are about 4-times as long. St. 4. Pod with weak prickles on the sutures.

Common in the damper districts in open places, waysides, etc., or in partial shade. In the dryer districts is chiefly confined to damp sandy ground. It occurs inside the Lachmidungri forest near streams in Sambalpur and is thoroughly naturalised. Originally from tropical America (Brazil). Fl., Fr. r.s. and c.s., also found in fruit in Puri in March.

On the irritability of the Sensitive Plant see Sachs, *Physiology of Plants*, English edition, p. 644.

2. *M. himalayana*, Gamble. Syn. *M. rubicaulis*, F.B.I. (in part);
Shiah-kanta, H.; Kundaru, K.; Segaj-anum, S.; Khirkichi-kanta, Or.

An erect or sub-erect very prickly weak shrub 6-10 ft. high with many stems. Branches angular, densely tomentosely pubescent when young, with close scattered slightly curved prickles. Leaf rhachis 4.5-8" very prickly, with 8-12 prs. of pinne '7-1.5" long. Lfts. 16-20 prs. or only 10 on the basal pinne '15-27" oblong. Fls. pink, in heads about '5" diam. on peduncles '7-1" long which are 2-4-nate, axillary and in long thyrsiform racemes in the axils of undeveloped leaves with filiform stipules '2-2.5" long. Pod linear-oblong curved (or straight, *teste Gamble*), 2-3" long, 4-10-jointed and -seeded, glabrous with attenuate base and apiculate apex tipped by the long style. Sutures slightly aculeate or unarmed.

Very common in low jungles, forest glades and sometimes in hedges. Furneah, abundant! Soane River, Bihar (with aculeate pods), J.D.H.! Chota Nagpur, frequent! This, or one of the forms of the *M. rubicaulis*, F.B.I., occurs throughout the area, but whether the Khirkichi-kanta of Puri, Angul and Sambalpur is



M. himalayana remains to be ascertained, as it was merely noted by me as *M. rubicaulis* (sensu F.B.I.). Fl. r.s. to Oct. Fr. Jan.-April.

Lfts. with obtuse or subacute mucronate tip and semi-rectangular base, hairy beneath, mid-rib nearer the upper margin, sec. n. faint, about 5, looping. Bracteoles among the flowers minute clavate pubescent. Calyx campanulate, 1 mm. long, glabrous. Corolla funnel-shaped, 2.5 mm. long, lobes 4 oblong as long as the tube. St. 8, long-exsert. Ovary glabrous.

In Angul "Khirkichi" is said to be used for gunpowder charcoal. In Manbhum the powdered root is given for vomiting arising from weakness, Campbell.

9. ACACIA, Willd.

Erect or climbing, usually armed trees or shrubs with either 2-pinnate leaves or the leaves transformed into green variously shaped phyllodes. Leaflets when present usually small. Stipules sometimes transformed into spines, stipellæ 0. Flowers small in heads or spikes, usually 5-merous, sometimes polygamous, each subtended by a bract. Calyx campanulate, toothed. Corolla free from the calyx-tube, more or less gamopetalous. Stamens many, free or connate with one another and to corolla at the base only. Pod usually flat and dry, sometimes moniliform and turgid but never breaking into joints, usually dehiscent.

The germination in species examined is epigeal, the cotyledons rather fleshy, sessile or shortly petioled, ovate to oblong. There is a curious disc-like growth in some cases separating the hypocotyledonary axis from the root. The stipules are from the first often converted into spines.

§. Leaves not converted into phyllodes.

I. Flowers in globose heads.

A. Armature stipular in origin and therefore usually geminate, spines straight.

1. Heads axillary, yellow or orange.

Shrubby. Pinnæ 4-8 prs. Pod 2-3", turgid . . . 1. *Farnesiana*.

Arboreous. Pinnæ 3-9 prs., '5-2" long. Pod moniliform . . . 2. *arabica*.

Pinnæ 4-6 prs., up to '5" long only. Pod even . . . 3. *eburnea*.

Pinnæ 7-14 prs., '5-1.5" long, tomentose . . . 4. *tomentosa*.

2. Heads paniced, nearly white . . . 5. *leucophlœa*.

B. Armature not stipular. Usually of scattered curved prickles.

[Heads 1-7-nate appearing paniced (exc. *concinna*) from the leaves in the axils of which they arise being undeveloped at the time of flowering.]

1. Small erect tree.

Pinnæ 16-20 prs. extending almost to base of rhachis.

Lfts. '25-5" long

6. *Donaldi*.

2. Climbers or scrambling woody shrubs, rarely sub-erect.

a. Pod thin.

Pinnæ 8-20 prs. Lfts. '2-35" long linear . . . 7. *pennata*.

Pinnæ 8-20 prs. Lfts. '15-2" long linear . . . 8. *canescens*.

Pinnæ 12-20 prs. Lfts. '25-3" oblong, hairy . . . 9. *torta*.

Pinnæ 6-8 prs. Lfts. '3-7" linear-oblong . . . 10. *casia*.

b. Pod thick.

Pinnæ 3-6 prs. Lfts. '4-6" . . . 11. *concinna*.

II. Trees. Flowers in spikes. Spines usually stipular, short and curved.

A. Lfts. under '5" long.

Pinnæ 7-24 prs. Bark very dark . . . 12. *catechu*.

Pinnæ 10-20 prs. Bark very light . . . 13. *suma*.

Pinnæ 3-5 prs. . . . 14. *ferruginea*.

B. Lfts. '75-1.5" long

. . . . 15. *lenticularis*.

§. Leaves converted into phyllodes (introduced species).

Phyllodes 4-7" long. Pod spiral . . . 16. *auriculiformis*.

1. *A. Farneesiana*, Willd. Dei-babul, Bilaiti-babul, Gand-babul, H.; Gabur, S.; Kapur, Or.; Guyababla, Beng.

A shrub or small tree 12-20 ft. with 4-8 prs. of short pinnæ, and 10-20 prs. of minute crowded leaflets '07-15" long. The branches bear small usually slender stipular spines '12-7" long. Heads of deep orange deliciously fragrant flowers '6" diam. on peduncles 1-1.5", usually clustered on abbreviated shoots from the axils of fallen leaves, also axillary. Pod 2-3" long, brown, turgid, '5-6" thick, curved, not dehiscent. Seeds dark-brown, more or less oval, '25" scarcely compressed.

Cultivated in gardens throughout the province and often self-sown. It is a native of the West Indies. Fl. chiefly Sept.-Feb. Fruits may be found most of the year, ripen April and fall in the monsoon.

Branchlets often zigzag, lenticellate. Leaf rhachis with short petiole pubescent, often ending in a spine, a gland often present above the petiole, pinnæ '5-1" rarely 1.5" long.

If pruned it makes a very beautiful garden shrub covered with innumerable yellow fragrant heads which under the misnomer of "Cassia flowers" are used in perfumery. The roots have a smell of garlic and with the pods are said to be rich in tannin.

Cotyledons oblong.

2. *A. arabica*, Willd. Babla, Babur, Gabla (*teste Draper*), K., S.; Babul, Kikar, H.; Bambur (in Sambalpur).

A tree attaining 45 ft. girth, but often flowering as a shrub, with long straight white (stipular) spines '25-2" long on the branches. Leaves with 3-6 (seldom up to 9) prs. of pinnæ '5-2" long, each with 10-20 prs. of leaflets '12-25" long. Leaf rhachis with a cup-shaped gland at the base of the lowest and generally also of the uppermost pair of pinnæ. Heads of yellow flowers '5" diam. on short axillary slender fascicled peduncles with two bracts a little above the middle. Pod indehiscent whitish tomentose 3-9" long, deeply constricted between the seeds.

The distribution is peculiar and appears to depend mainly on soil and the absence of competing species. Purneah! Dryer tracts of Behar and Tirhut, on alluvium! Other districts of the Central and Northern tracts mainly on spoil banks and railway embankments, where also it is sometimes planted. Santal Parganas, on Cotton soil! Southern Tract, common in Khendpara and Banki on Cotton soil and in parts of Puri! Sambalpur, rare, and chiefly on Cotton soil! It appears to avoid Metamorphic rocks and is absent from all the more fully stocked forest areas. Fl. Aug.-Dec. Fr. Jan.-April. Evergreen.

Bark deep brown or black deeply cracked, blaze very hard, deep brown-then pink.

The wood is good and durable and valuable for agricultural implements. The bark is very largely used for tannin in upper India but Babul-tanned bark is less suitable for further finishing in Europe than the so-called half-tans (e.g. tarwad). The seedling is very impatient of grass and other competition and it requires to be raised on clear soil in even-aged crops. In my experience it does not coppice, and in his paper read before the Tannin Conference Mr. Tireman says that "in general it does not coppice well," but other foresters speak of its coppicing. The tree produces the Indian Gum Arabic. The true Gum Arabic (*nilotica*) has not the white tomentum on the pods and the very moniliform pods have oblique joints. Drainage is said to be one of the essentials of its silviculture, yet it appears to thrive on badly drained cotton soil.

The cotyledons are ovate and very obtuse with the base somewhat auricled and bevelled. The roots like the last have an alliaceous odour. The pods are largely eaten by goats and the seed which passes is the best for germinating.



3. *A. pseudeburnea*, Drummond (in Kew Herb.). Syn. *A. eburnea*, Willd. (in part).

A shrub or small tree with long straight dark-brown spines which become white on the older branches. Leaves small 1-1.5" with hairy rhachis ending in a spine or point and 4-6 rarely 8 prs. of small pinnae about .5" long with 6-12 prs. of rigidly coriaceous greyish-green leaflets .08-.12" long. Peduncles about 1" very slender grey-downy with connate bracts about the middle. Heads .3-.4" diam., corolla pale yellow (always?). Pod 3-6" long, thin, flat, straight, glabrous and shining.

Behar, Kurz! There is only one specimen from Behar, and a very poor one in fruit. The species apparently just enters the province from Oudh and the North-West. Fl. Nov.-Jan.

Bark dark grey or reddish-brown. Spines .25-2", slender in our specimen. Branchlets hairy. Rhachis with a large gland between the uppermost pinnae and (fide Duthie) between each of the two lowest pairs. Sec. rhachides also often ending in spines. Lfts. oblong about .1" long mucronulate. Pod .25" broad.

This tree appears distinct from the South Indian true *A. eburnea* in the larger number of pinnae, more slender spines, and the yellow not purple corolla. But it is to be noted that Roxburgh's figure in *Pl. Coromand.* shows the leaves of *Mimosa eburnea* with 4-8 prs. of pinnae .25-.5" long and corolla purple!

4. *A. tomentosa*, Willd.

A small tree with the twigs, leaves and spines covered with grey tomentum. Leaves 2-3.5" long with several glands on the rhachis and 7-14 prs. of pinnae .5-1.5" long, each pinna with 15-30 prs. of oblong pubescent leaflets .1-1.5" long. Stipular spines straight grey reaching 3" in length on the branches and stems. Heads .5" diam. on stout peduncles 1-1.5" long with median bracts. Pods curved yellow-brown or reddish 4-5" long by .4", flattened, slightly depressed between the seeds, pedicelled. Seeds 6-10, pale grey compressed oval .3" long.

On cotton soil, Puri, Southern Range! Fl. May-June. Fr. April.

5. *A. leucophlœa*, Willd. Goira, Gohira, Or.; Gulura, Reimja (Sambalpur).

Usually a small tree but attaining 6 ft. girth with white smooth-barked branches, sometimes unarmed. Twigs and leaves tomentose. Leaves small, 1-3" long with 6-12 prs. of pinnae .7-1.5" long each with 15-30 prs. of crowded leaflets .12-.3" long. Flower-heads small .2-.25" diam., nearly white, numerous in large terminal tomentose panicles, bracts on peduncles median. Pods long linear curved, panicle, 4-8" by .2-3" tomentose.

Southern parts of the province only, chiefly on cotton soil not on metamorphic rocks. From Balasore and Cuttack to Sambalpur! Not frequent in the better forests, where the seedlings get suppressed, though old trees may sometimes be seen. Fl. Aug.-Oct. Fr. Dec.

Lower parts of large trunks with very rough ragose bark which may turn nearly black, the upper part remaining white. Blaze light red slightly white-streaked. Rhachis with a gland sometimes at each pair of pinnae. Seeds 8-12.

Seasons well and takes a fine polish, strong and tough, but often eaten by

* I have no field notes on the dimensions of the leaves, and I suspect that the measurements given, taken from Herbarium material, are as usual too small, as these are usually associated with the inflorescence.

insects. An excellent fuel for locomotives," *Brandis*. It does not seem to be much used in this province. A fibre is obtained from the bark by steeping for several days and beating it. *Gamble* gives weight as about 55 lbs.

6. **A. Donaldi**, *Haines* (*Indian Forester*, Feb., 1917); *Gar Khair*, *Burkeli*, *Or.*

A small tree up to 2.5 ft. girth, very rarely sub-scandent. Branches with usually 5 lines of minute prickles, twigs finely pubescent, usually armed with short recurved prickles but stipular spines absent or rudimentary. Leaf-rhachis 3-10" (usually 4-5.5") with very short swollen petiole and a flattish or rudimentary gland on rhachis immediately above it and between each of the 3-4 upper pinnæ, rhachis with very small weak prickles on the lower rounded surface. Pinnæ 10-27 (usually 16-20) prs. 3-5" apart and extending down the rhachis to within half an inch of base of petiole, median 1.5-2" long with 25-40 rarely 50 prs. of linear leaflets 25-5" by .03-.05". Pods green to pale yellow and whitish-brown, ultimately grey, rather turgid when unripe, up to 25" thick, base attenuate, but pedicel, if any, not exceeding .2".

Sambalpur, especially on the quartzites and shales of the Boropahar Range! Fl. July-Aug. Fr. Nov.-Jan.

Bark light-coloured, blaze slightly pink-streaked or pink in older trees. Foliage often fascicled, sparsely rigidly ciliate, rhachis pubescent above, lfts. mucronate, base obtusely semi-sagittate or hastate with oblique costa, under surface pale with microscopic hairs. Stipules 12-16", fugacious. Heads white or cream coloured about 5" diam. on peduncles 58-8" long usually 3-nate in the axils of bracts. These are really very young leaves and develop later so that the fructiferous peduncles become axillary. Calyx 14" almost glabrous 5-nerved with acute lobes. Corolla quite free from calyx, glabrous, length (measured from base of flower) 17-19". Stamens very shortly connate at extreme base and also adnate to base of corolla. Ovary sericeous with long stipes .08" long.

The pods and seeds occur under two forms: (a) length 3-5" by .8-1" with about 6 oblong brown seeds; (b) length 5-6" by .8" with rounder darker seeds.

The germination is only sub-epigeal, the cotyledons are thick, oblong, and there is no hypocotyl but a thickening at the base of the cotyledons, a pair of 2-pinnate leaves and a stem between them arise immediately from the cotyledonary axis. The first leaves, which end in a point, bear two prs. of pinnæ and normal erect stipules.

The seeds are much punctured by one of the Bruchidæ, identified at the Forest Research Institute as a species of *Caryoborus*.

7. **A. pennata**, *Willd.* Syn. *Kundaru*, *K.*; *Kondro-janum*, *S.*; *Arar*, *Kharu.*; *Dontari*, *Nali Konti*, *Or.*

A large woody climber. Branches usually more or less 5-angled with lines of small prickles on the angles which sometimes persist even on the rounded stems. Leaves like those of *A. canescens* but pinnæ usually fewer, leaflets rarely 60 prs. less sensitive and more usually spreading, 2-35" and "broader,"* green, glabrous or only ciliate on the margins. Rhachis often more aculeate. Inflorescence (in my specimens) smaller, under 6" long, peduncles thinly pubescent or nearly glabrous. Bracts subtending the flowers very small without

* But I cannot follow altogether the distinctions between these two species given in the *Flora of Madras*. One of these is that the leaflets of *canescens* are always acute, yet some specimens named at Kew have not only obtuse but rounded tips to the leaflets. The leaflets in *pennata* are said to be linear-oblong and those in *canescens* linear, but the proportionate breadth seems to me the same.



The dilated tip which usually occurs in *A. canescens*. Flowers as in *A. canescens* var. *albida*. Pod .75-1" broad.

Behar, Soan River, *J.D.H.*! Sikkim Tarai, and therefore probably all through the Northern Area! Fl. r.s., Fr. c.s.

In Behar specimens the median leaflets are .17-.3" long, with mid-rib nearer upper edge at base but nearly central at tip, the base is rounded rectangular with about 4 small nerves. Pods variable but always purple when young, 5-7" by .7-1.3", suddenly obtusely acuminate or acute.

8. *A. canescens*, *Grah.* Syn. *A. pennata* var. *canescens*, *F.B.I.*; Kundaru, *K.*; Kondro-janum, *S.*; Arar, *Kharw.*; Dontari, Nali Konti, *Or.*

A large woody climber. Branches usually more or less 5-angled with 5 lines of small prickles even when old. Shoots and twigs grey- or fulvous-tomentose. Leaf rhachis without or with only very few prickles 3-8", with a large gland between the very short swollen petiole and the pinnæ, a gland also between 2-3 of the uppermost pinnæ, rhachis permanently pubescent or glabrescent with 8-20 prs. of pinnæ the lowest of which is usually from 1.5-2" distant from base of petiole. Pinnæ .25-.5" apart, 1.5-3" long with 40-80 prs. of very small linear leaflets .15-.2" long permanently hoary beneath. Pod thin flat dry with strong sutures 4-6.5" by about .7", deep brown or purple, margins sometimes sinuate.

In all districts, chiefly near nalas in the dryer ones. Purneah (or Sikkim Tarai)! Soane River, Shahabad and Plains of Bihar, *J.D.H.*! Gaya! Singbhum! Gangpur! Hazaribagh! Santal P.! Puri (var. *fulva*), ascending to the tops of the hills at Rajim! Fl. May-Aug., sometimes earlier in wet seasons. Fr. ripens following April.

Bark light-coloured. Blaze crimson (this may possibly be *pennata*). Lfts. with rounded apex or (in var. *fulva*) acute. Construction of inflorescence as in the last. Peduncles often 4-nate and with 1-2 linear deciduous bracts. Calyx .08-.09" long. Corolla (from base of flower) .1-1.2". Seeds up to 12 black, oblong, .4-.5" long by .3".

There are two varieties, perhaps as distinct from one another as they are from *pennata*. Indeed I only keep *A. canescens* distinct from *A. pennata* to be in uniformity with the *Flora of Madras*.

Var. *albida*. Lfts. with rounded apex, glabrescent or nearly so, costa nearly central at apex. Flower quite glabrous or ovary minutely sericeous, calyx with a delicate median nerve to each sepal.

Var. *fulva*. Shoots densely rusty tomentose, indumentum more permanent, leaflets very acute with costa close to upper margin. Calyx minutely pubescent, not nerved. Ovary sericeous.

Mals of Puri only.

9. *A. torta*, *Craib* (*Kew Bulletin*, No. 9 of 1915). Syn. *A. cæsia*, *W. & A.*, *A. Intsia* var. *cæsia*, *F.B.I.* (As pointed out in my *Descriptive List of Trees, etc., Central Provinces*, this is not the *Mimosa cæsia* of Linnaeus, and Mr. Craib has renamed it in *Kew Bulletin*, 1915, No. 9.) Same vernacular names as for *A. canescens* and *A. pennata*, also Dontari, Konti, *Or.*; Dater, *Khond* (?).

A large scrambler or climber with the stems very often channelled or 5-angled. Branches with 5 lines of prickles, young tomentose. Leaf rhachis densely pubescent or tomentose, 6-10" long with small recurved prickles and a depressed or conical gland at base, pinnæ

12-20 prs. 3-4" long (some only 2" or reaching 5"), pubescent 4-5" apart, lfts. oblong 30-45 prs. rigidly spreading (except in sleep) 25-31" by 1-15", always somewhat pubescent beneath. Heads white, copiously paniced. Pods flat dry with strong sutures, 3-5.5" by 6-1" light brown, usually cuneate both ends, with a rusty tomentum when young.

Central and Southern areas, probably in all districts. Behar, T.T.! Monghyr, Ham.! Gaya! Santal P.! Chota Nagpur, all districts! Mayurbhanj! Narsingpur! Angul to Sambalpur! I am doubtful whether it occurs in Puri, where the next species has been collected. Fl. May-Sept. Fr. Jan.-March. Evergreen.

Trunk attains 2.5 ft. girth with rough bark, brown blaze, on younger stems bark light-grey nearly smooth and blaze slightly pink. Wood light-brown or reddish, structure normal, falsely ringed with soft tissue in which the pores are.

NOTE.—The leaf rhachis includes that part of it usually termed the "petiole" below the pinnae and down to the true thickened petiole.

10. *A. cæsia*, Willd. Syn. *A. Intsia*, F.B.I. Same vernacular names as for *A. torta*.

A large climbing shrub with stout 5-angled stems with minute prickles. Twigs sometimes circinate. Shoots pubescent or tomentose with sharp recurved prickles. Leaf rhachis 4-8" long pubescent, sometimes glabrescent, aculeate, with a large linear-oblong swollen gland at the base often with free conical apex, and a large gland just below 3-4 of the uppermost pinnae. Pinnae 6-8 prs., 1.5-3.5" long, rhachis at first closely pubescent or pilose, afterwards thinly so, 5-1" apart with a distinct short petiolule and two setaceous stipellæ above the petiolule (these are present in *A. torta*, but are more minute and hidden by the indumentum). Lfts. 8-15 prs. usually shining (often steel-blue in herbarium), obliquely oblong, sessile, mucronate, smaller 3", larger (on the same plant) 7" long by 2.7" wide, with a few fine hairs beneath when young but glabrescent. Panicles axillary and terminal, very narrow and lax up to 18" long with the future leaves very minute and bract-like, heads 5-7-nate, red in bud, 5-6" diam. Fls. white with tip of calyx and corolla often red. Bracts between flowers oblong-spathulate acute ciliate. Calyx .08" (or 1" in fresh specimens), length to tip of corolla 1-12". Stamens 25-27" long. Pod thin with thickened sutures, dark brown, 4.5-6" long by .8-1" broad, base rounded or cuneate, stipes 2-25". Seeds 4", dark polished brown, oval, flat.

Southern Area only, in extreme south. Puri! Angul! Fl. Sept.-Oct. Fr. April. Renews leaves as in other species at time of flowering or immediately after flowering.

I have had to describe these species at great length on account of the confusion existing in works as to their distinctive characters.

11. *A. concinna*, DC. Syn. *A. rugata*, Ham.; Ban-ritha, Beng.

A large very prickly scrambling shrub with pale-grey twigs copiously armed with hooked prickles. Leaf rhachis 3-5.5" long pubescent with 3-6 prs. rarely up to 8 prs. of pinnae, of which the median are about 2.5" long with 9-15 prs. of leaflets 4-6" long and 2" broad. Flower-heads appearing with the more or less developed leaves, not paniced but 2-4-nate in the leaf axils and below them

(scale axils), cream-coloured or pink, 4-5" diam. Pods thick and fleshy, depressed between the seeds and margin often constricted, but finally dehiscent, 2.5-4" long by .7-1" broad, beaked.

Throughout the area but not common. Ramnagar Hills! Purneah! Valleys in Singbhum! Puri! Angul! Fl. April-June. Fr. ripens following March. New leaves in March-April. In Purneah a sub-arboreous specimen was found.

Branchlets often nearly white. Shoots pubescent. Pinnæ 5-1" apart. Length of flower to tip of corolla 11-13". Calyx .087", minutely thinly pubescent. Ovary usually glabrous or nearly so in our area.

Var. *rugata*, F.B.I., is distinguished by the larger leaflets and pods and villous ovary. The *Flora of Madras* keeps *rugata*, Ham., as a distinct species from *concinna*. I am unable to accept the validity of the distinctive characters given as my specimens have pinnæ only 3-6 prs. and an all-but glabrous ovary. The young pods in the Ramnagar specimen have very minute scattered thin hairs and the ovary may therefore have been pubescent; the leaflets are, however, those of *concinna* and the pod is only .7" broad.

The pod is saponaceous and used for washing.

12. *A. catechu*, Willd. Khair, H., S.; Khoiru, Or.

A small tree with black bark, branches slender armed with geminate (stipulary) hooked spines. Pinnæ 7-24 prs. with their rhachis from .5" (on very small leaves) to 1.5" long, pubescent or hairy, with 6-35 but mostly 12-20 prs. of sessile ciliate leaflets .1-2" long. Fls. small white or pale yellow, crowded in pubescent spikes 2-3.5" long, axillary on the young shoots. Fls. .08-1" long excluding stamens, the corolla one-and-a-half to usually two times as long as the calyx, both pubescent or petals densely hairy, greenish with membranous margins. Ovary glabrous stipitate. Pods 2-5" by .6-8" often irregularly constricted, 4-7- rarely only 2-seeded, obtuse mucronate or beaked, base contracted into a pedicel and pubescent, above glabrescent, dehiscent.

Central and Southern Tract, usually in dry forest! Gaya! Palamau, common, and often found mixed with the Sal both on clay and sandstone! Hazaribagh, esp. on sandstone and often mixed with Sal! Maubhum! S. Parg., especially on cotton soil! Athmallik! Narsingpur! Angul! In all the Orissa States, Cooper.

Bark peeling off in thin vertical strips, blaze very hard vandyke-brown, then deep pink, twigs pubescent. Main rhachis 2-6" rarely 8" with a gland below the pinnæ and one between the uppermost 1-6 pinnæ. Peduncles sometimes paired .5". Stamens in 5 bundles at base of corolla with long glabrous or very sparsely hairy filaments.

A valuable wood, strong and very durable, largely used as house posts. The wood yields, by boiling the chips, the well-known Kath used for chewing with Betel and in medicine, and Catechu, used for tanning. These have for long been manufactured in Palamau, Maubhum and Hazaribagh. Kath is a valuable astringent.

The open Khair forests are largely a result of treatment by man, and where cattle and fires are kept out the Khair tends to die out, as it neither seeds nor coppices under shade—a point which has sometimes been lost sight of. The weight of the wood as given by Gamble is about 50-60 lbs.

The cotyledons are orbicular-oblong .25" long with auricled-cordate base. The first stipules are erect and normal, the first leaves with only two pinnæ.

Var. *a catechuoides*, Wall. sp.

A straighter tree than *A. catechu* and chiefly distinguished by the puberulous not pubescent rhachis and glabrous calyx and corolla.

It is more a tree of river-beds where it occurs in the sub-Himalayan tract in northern Purneah! This may also be the tree of Bettiah and Ramnagar, but the Khair of that district was not examined by me.

13. *A. suma*, Ham. San-kanta, Beng.

A tree much resembling *A. catechu* but with white bark, more flexuose branches and with the corolla not much exceeding the calyx.

Manbhum, Raganathpur, Clarke! Balugaon, Puri! Gamble says common in Orissa, but he probably refers to Orissa in its wider sense. Patna and Kalahandi, Grieco. Fl. Aug. Fr. Dec.

Branchlets and petioles grey-pubescent. Leaves 4-10" long with a large gland above base of petiole. Pinnæ 10-20 prs., leaflets 20-50 prs. generally ciliate. Flower usually under '08" but the relative length of calyx and corolla is variable. In nearly all the specimens I have seen the calyx is not much more than half as long as the corolla, in some three-fourths or two thirds. Pods 2-5" by '75" pubescent when young.

The wood is said to be similar in its properties and uses to that of *A. catechu*.

14. *A. ferruginea*, DC. Safed Khair, H.; Kanta Chira, Or.

A fairly straight tree 2-4 ft. girth. Branchlets pubescent with small stipulary prickles 1-15" slightly curved. Leaf rhachis 1.5-2.5" with 3-5 prs. stalked pinnæ each with 10-18 prs. lfts. Lfts. 2.5-3.5 glaucous, almost white when dry. Pod about 4" up to 6.5" long by '8", 4-6-seeded, upper suture margined. Spikes 3-4".

This is also a rare tree in our area, only found by me in the Bolong Forest, Angul! It will probably also be found in Kalahandi and the Khondmals. Fl. Mar.-April. Fr. Nov.-Jan.

Bark grey, cracking into oblong pieces. Blaze light crimson or in old trees deep crimson, with thin white lines. As the tree is nearly bare of leaves at the time of flowering the spikes appear paniced.

15. *A. lenticularis*, Ham. Khairi, Ur.; Kolsa-kanta, H.; Balu Tentul, Mal. P.; Kanta Siris, S.

A pretty tree, 20-40 ft. high, at first sight much resembling an *Albizzia* or *Siris*, with bright green foliage and large leaflets. Pinnæ 2-4, more rarely 5 prs., 3-5" long. Lfts. 7-12 prs. oblong or obovate-oblong sub-sessile glabrous or nearly so '75-1.5" by '6". Fls. pure white in stout dense spikes 4-5" by '75" with hairy rhachis. Pod flat straight 5-9" by 1-1.5".

Hill forests, central and southern tracts. Hazaribagh, frequent, esp. on quartzite, on clay schists near the Damuda! Palamanu, Kumandi reserve and Adhe, on banks of streams! Ranchi Ghats, common! Common about Neterhat, 3000 ft.! Porahat, Kondrugutu forests! Rajmahal Hills, not common! Kalahandi, Grieco. Fls. May-June. The pods seem to ripen about Oct. and Dec., but remain on the trees often till following April. Evergreen.

Attains 7.5 ft. girth in Palamanu. Old bark brown-grey or dark-grey with oblong flakes and blaze deep crimson. The old trees are nearly unarmed or with straight slightly recurved stipulary compressed spines. Leaf rhachis 5-7" glabrous or slightly hairy with a gland below the pinnæ. Lfts. margined with rounded apex and oblique base, mid-rib nearly median. Calyx slightly hairy, teeth nearly as long as tube. Petals greenish, twice the calyx.

Frost-hardy and ornamental, but the timber is said to be attacked by white ants, though very hard and strong.

16. *A. auriculæformis*, A. Cumm. (Benth. in Hook. Lond. Journ., i, p. 377.)

A rather tall straight tree with smooth white bark, sometimes taken for a *Eucalyptus*. Glabrous and glaucous with slightly angular branchlets. The place of leaves is taken by large laterally



Compressed falcate-oblong phyllodes 4-7" long and 5-1.5" broad, narrowed both ends with 4-6 principal sub-parallel nerves sometimes confluent near the base and finer parallel intermediate occasionally anastomosing. Flowers small white in slender axillary spikes 1.5-2.5" long, calyx broadly campanulate .02" long minutely toothed, petals spreading as long as the calyx. Pod hard, almost woody, much twisted in an irregular spire with the outer edge often sinuate as in some *Pithecolobium*.

Frequently planted as in Bankipur! Fl., Fr. at various times of the year.

Native of N. Australia and Queensland.

A few other Australian phyllodineous *Acacias* are sometimes met with in gardens, but the above is the only common one. All transitions occur between phyllodes and true leaves and the seedlings of phyllodineous *Acacias* have usually normal leaves.

10. ALBIZZIA, Duraz.

Unarmed trees with 2-pinnate leaves. Flowers in globose heads rarely subtended by bracts on 1-5-nate peduncles which are either axillary or in the axils of rudimentary leaves which ultimately develop, rarely truly paniced and in the axils of small or large bracts. Calyx tubular or campanulate, teeth usually small. Corolla gamopetalous usually exserted and with 5 petals. Stamens many more or less connate. Ovary sessile or shortly stipitate, many-ovuled. Pod linear or linear-oblong, flat, straight, thin, indehiscent or tardily dehiscent. Seeds exalbuminous, compressed.

- | | |
|---|--------------------------|
| A. Pinnæ 1-2 prs. only. Lfts. 2-5" long | 1. <i>lucida</i> . |
| B. Pinnæ 2-6 prs. Lfts. mostly over .75". | |
| Pinnæ 3-6 prs. Lfts. 1-2.3". Fls. sessile | 2. <i>procera</i> . |
| Pinnæ 2-4 prs. Lfts. .75-2.25". Heads axillary. Fls. pedicelled | 3. <i>lebbek</i> . |
| Pinnæ 2-5 prs. Lfts. .6-1.3". Heads paniced. Fls. sessile | 4. <i>odoratissima</i> . |
| C. Pinnæ mostly over 6 prs. Lfts. all under .75". | |
| Pinnæ 3-10 prs. Lfts. .5-.75". Fls. pedicelled | 5. <i>Thomsoni</i> . |
| Pinnæ 6-15 prs. Lfts. .1-.25", costa median | 6. <i>amara</i> . |
| Pinnæ 12-20 prs. Lfts. .15-.35", costa submarginal | 7. <i>stipulata</i> . |

1. *A. lucida*, Benth. Gobraha, Th.

A large or (in our area) m.s. or small tree. Leaves with 1-2 prs. of pinnæ only, rhachis with a gland near the base, glabrous. Rhachis of pinnæ 2-5" with 2-4 prs. of leaflets and a gland below all except the lowest pair. Leaflets elliptic-oblong acuminate dark green and shining, paler beneath, 2-5" long by 1-1.5" broad, penninerved and reticulate, young thinly pubescent. Heads small, peduncles slender, .3-7" long, 1-4-nate in short axillary pubescent glabrescent panicles 2-3" long. Flowers sessile, calyx with short lobes, corolla exserted to about twice the length of the calyx. Pod brown thin shining 5-9" long by .8-1.3".

Bettiah and Ramnagar forests, near streams! Probably also in Purneah. Fl. April-May. Fr. March-April. Evergreen.

Bark light, nearly smooth. Blaze yellow and white.

The wood is said by the Tharus to be very strong and to be used for carts.

2. *A. procera*, Benth. Kare, Th.; Pandrai, K.; Safed Siris, H.; Garso, Kerso, Kharw.; Tentra, Or.

A large tall tree with characteristic greenish-white or white bark (except on very old trunks). Leaves with 3-6 prs. of pinnæ. Pinnæ

with a gland below the upper 1-3 prs. of leaflets or not. Lfts. 5-11 prs. broadly oblong or rhomboid-oblong 1-2.3" by .5-1.2"; much broader on the forward (acroscopic) side of the costa than on the basiscopic side, the costa being nearer to the lower edge except at the apex. Heads 1-4-nate copiously paniced, bracts caducous. Exserted part of corolla 1-1.5 times length of calyx. Pod 4-8" by .5-1", thin strap-shaped, young often red.

In damp ground, along watercourses, etc., in all districts. Also occasionally planted but only attaining perfection in the forests near streams. Fl. Aug.-Sept. Fr. Dec.-May. In May and June it may be nearly or quite leafless for a very short time. There may be a second flush of new leaves in August growing through the panicle.

Attains 7-8 ft. girth. Blaze red. Youngest leaves silvery hairy, quickly glabrescent. Panicles nearly glabrous, large or only 3-4". Calyx 1-1.2" glabrous, teeth unequal. Corolla greenish-white, nearly .25" (measured from base of flower) and lobes about one-third as long. Fil. white, anthers yellowish, staminal-tube exceeding the corolla.

The timber is good. Carts are made from it in Champaran, it is used also for building, rice-pounders, etc. It is a good fuel. Gamble gives the weight at about 40-50 lbs. It grows very rapidly.

3. *A. lebbek*, Benth. Syn. *Acacia Lebbek*, Willd.; *A. Sirissa*, Roxb.; *Siris*, H. Beng.; *Shirson*, Or.; East Indian Walnut.

A large or m.s. tree usually noticeable when leafless from the numerous pendulous straw-coloured pods. Leaves with 2-4 rarely 5 pairs of pinnae, rhachis with a gland below the uppermost pair of pinnae and at the base. Pinnae with a gland below the 2-5 upper prs. of leaflets. Lfts. 6-8 prs. rarely up to 13 prs., oblong .75-2.25" by .35-1" rarely twice as long as broad, rounded glabrescent, drying green, costa not less than one-third diam. of lft. from and parallel to its upper edge. Peduncles stout 2-4" long, 1-3 together in the axils of the leaves of the young shoots, rarely sub-paniced from the late development of these. Flowers with distinct pedicels which attain .2" long. Corolla exserted to twice length of calyx. Pods linear-oblong 6-12" by 1-2" broad.

Everywhere planted, very commonly along roadsides. Apparently wild in the Sameshwar Hills but rare! Hamilton speaks of a *Sirish* in Purneah allied to *Lebbek*, if not it. Apparently wild on the Damuda ghats, the Kuru ghats, in the hills above Ader (Ranchi), below Korgi and Adhe (Palaman), all in Chota Nagpur! Apparently wild along streams near Nakchi and Lohamunda (Athmallik)! Also in the Tikapara forest, near the Mahanadi and at Baghmunda, Angul! and in the Mals of Puri! Fl. April-June. Fr. ripens January and remains on the tree till the following March or April. Leafless during the hot season.

Bark rather rough and rugose, cinereous. Blaze deep crimson or red. Shoots, young leaves and inflorescence densely (often yellow-) tomentose. Stipules .17" linear deciduous, 2 minute stipellæ above the thickened petiole of the pinnae when young. Lft. with 4-5-nerved base. Fls. scented, with a pedicel 1-1.2" long. Calyx .12" pubescent. Corolla tubular-ventricose, often .3" measured from base of flower, slightly hairy above with lobes nearly .12".

Var. *rostrata*, Haines. Bark rough even on branches. Pod with a very long sharp beak. Wild below Korgi and Adhe, Palaman, near hill streams.

Var. *pubescens*, Haines. Tomentose, leaflets more or less permanently hairy and more narrowly oblong and up to 13 prs.

It is practically indistinguishable from the next species without flowers and fruit, and as the flower pedicels are also shorter than the type it is probably a hybrid.

Palaman near Daltonganj, probably of nursery origin.

The wood of *A. lebbek* is not much used in the province. Gamble says that it seasons.



works and polishes well and is fairly durable. The weight is given as about 50 lbs. It is very fast growing, but as an avenue tree its leafless condition and the dismal rattle of its pods in the hot weather make it very inferior.

4. *A. odoratissima*, Benth. Gobraha, Th.; Kiachalom, K.; Jang Siris, S.; Sirish, Tinia, Or.

A large or small tree, some forms graceful with drooping foliage. Leaves with 2-5 pairs of pinnae, main rhachis with glands as in *lebbek* or glands abortive. Pinnae with rhachis 3-10" long, a gland between the upper 1-2 prs. of leaflets rarely absent. Lfts. 6-24 prs. (on same individual), oblong to narrowly oblong and sometimes sub-falcate 6-13" by 2.5-5", mostly under 1" and twice to three times as long as broad, usually drying grey, finely appressed silky both sides, costa about one-fourth diam. of lft. from the upper margin. Peduncles 7.5-12.5" long, 1-3 together in usually ample terminal panicles.* Flowers sessile. Corolla exserted to 4-5-times the length of the calyx. Pods purplish-green to brown or red when quite ripe 5.5-12" long by about 1" rarely 1.25" broad.

In all districts! Chiefly in valleys. Fl. May-July. Fr. Nov.-Feb. Evergreen. The new leaves usually following the flowering, or with the flowers.

Bark grey or sand-coloured, blaze thick deep crimson. Shoots and panicle densely pubescent or tomentose. Leaf rhachis pubescent, lfts. pale beneath, silky or nearly glabrous except the margins and mid-rib, basal nerves 5-6. Calyx campanulate, .05-.08", pubescent, scarcely toothed. Corolla hairy all over, funnel-shaped with tube exserted and lobes one-third to as long as tube, whitish. Filaments 6-7" long.

The wood is used for much the same purposes as *A. lebbek* and is said to be durable. Gamble gives the weight as about 50 lbs. and says that it works and polishes well. It is sometimes lopped for fodder.

5. *A. Thomsoni*, Brandis. Sailari, Gondi.

A large and handsome tree with the young parts tawny or golden tomentose and old twigs dark grey densely appressed-hairy. Pinnae 3-10 pairs 2-6" long. Lfts. 5-10 on the first leaves, up to 25 prs. on later leaves, very unequal sided, base and lower side forming a right angle, ultimately glabrous both sides but rhachis villous, larger 5-7.5" by 2.5". Peduncles appearing to be corymbose from the old branchlets but the young shoot bearing the inflorescence ultimately proliferous. Heads 7-9" diam. (with st.) sub-corymbose on slender peduncles 7-16" greenish-yellow. Fls. 17" with slender pedicels 1" long. Pods red 6-8" by 6-1" beaked, 6-8-seeded.

Angul; Tulka, Labangi, and Burkundi Forests! Fl. March while leafless. Fr. Nov.-Jan. The new leaves appear at the ends of the new shoots which bear the inflorescence during or just after flowering, rarely some peduncles also axillary in the new leaves.

Attains 6-7 ft. girth. Bark grey, smooth, slightly cracked below. Blaze dark crimson. Main rhachis with 1-2 glands between the uppermost pinnae and a very large one on petiole. Lfts. pale beneath, sometimes slightly falcate, tip rounded and mucronate. Petiolule very short villose. Fls. fragrant. Calyx .08" pubescent, teeth very small obtuse. Petals greenish 12" pubescent, exserted and free to a distance as long as the calyx, narrow ell.-oblong subacute. Fil. 4-5" long connate

* The panicle is always described as terminal and ample, but sometimes the bracts are replaced by young leaves and the inflorescence then assumes the form of that of *A. lebbek*. The two trees sometimes, I believe, hybridise (cp. var. *lebbekifolia* in C.P. list).

into a short tube at the base; white glabrous with greenish-yellow anthers. Ovary shortly stipitate, glabrous, or both it and young pod densely golden hirsute. (These last are diseased.)

Var. *galbana*, Haines.

It is remarkable that *Brandis* particularly states that the flowers are not scented and that the anthers are pink. He even says that these characters differentiate it from *A. odoratissima* and the *Flora of Madras* also quotes them. I have confirmed the observation in the Central Provinces, but our tree has scented flowers and greenish-yellow anthers! *Prain* in the *Calcutta Herbarium* writes—" *A. odoratissima* var. *mollis* = *A. Thomsoni*, which is not a good species." But the cover really contains a mixture of *A. odoratissima* with *A. Thomsoni* and this no doubt led to confusion. On no occasion on which I have seen *A. Thomsoni* in the forest have I for a moment confused it with *A. odoratissima* and it is an excellent species. The tree with scented flowers and yellow anthers I therefore consider as a variety of *Thomsoni*. The form, leaflets, time of flowering, character of inflorescence, pedicelled flowers and pod serve to distinguish it at every stage from *A. odoratissima*. The flowers are usually so high that I have always had to collect them by shooting down a branch; those of *odoratissima* can usually be reached from the ground.

6. *A. amara*, Boivin.

A small or m.s. tree with smooth greenish bark and the innovations softly yellow tomentose. Leaves with main rhachis 2-4" long and 6-15 prs. of pinnæ 1-3" long with numerous (15-25 prs.) close-set linear leaflets under .25" long with the costa nearly central. Fls. .14-.15" long (without st.) yellow, fragrant, in heads .3-.5" diam. (.3" without the stamens), peduncles .7-1" long rather slender, closely yellow hairy, 1-4-nate in the axils of scales and of the new leaves or appearing shortly panicle owing to late appearance of these. Pedicels short. Corolla exserted to two to three times length of the calyx which is sub-entire, petals lanceolate about half as long as tube. Pod 4-6" by .7-1" pubescent.

Fl. March-May.

The wood is strong.

Prain gives Orissa as a locality but I can find no specimens from our area either at Kew or Calcutta. The nearest locality where I have collected the tree was in *Raipur* in the Central Provinces!

7. *A. stipulata*, Boiv. Syn. *A. marginata*, Merr.; Kare, Th.; Kala Siris, H.; Japud, K.; Chapot, Kera-serom, S.; Ghora-lenja, Or.

A large handsome tree with feathery foliage. Pinnæ 12-20 prs. usually about 14 prs., 3-5" long with hairy pubescent rhachis and about 30-40 prs. of semi-lanceolate leaflets .15-.35" long with the costa close to the forward margin, young pubescent, mature pubescent at base, margin and costa. Stipules large caducous. Fls. (with stamens) 1-1.25" long on 1-5-nate peduncles often in the axils of stipuliform bracts in panicles 4-8" long. Pods 3.5-6" long by .6-.8" broad, dehiscent.

In the damper forests, usually near streams or ravines. Not common. Champaran to Purneah, frequent! Valleys in Singbhum! S.P., rare! Athmallik, near rivers! Angul!

Fl. May-June. Fr. Oct.-April. Evergreen or nearly so, new leaves Feb.-March. Attaining 8 ft. girth with a smooth pale grey bark with characteristic transverse furrows, but some forms when old have a rough bark below. Blaze crimson. Nearly all parts densely pubescent. Leaves about one foot long, sometimes likened to the Gul Mohur, whitish beneath. The large cordate stipules are very



conspicuous on the new shoots but so far from being persistent (as sometimes described) they are very caducous in our area. Fl. cream-coloured or white, sessile, the tubular-funnel-shaped calyx '11" long and the corolla twice as long or more, pubescent.

The wood is not used in the province but in some parts of India it is said to be used for building and for wheels. It was tried for tea-boxes in the Duars but there was no subsequent demand for it while I was in that district, though, under the name of "Sau," it was extensively planted both there and in Chota Nagpur among the tea, the growth of which it is supposed to improve. It is lopped for cattle fodder.

11. PITHECOLOBIUM, Mart.

Closely allied to *Albizia* but sometimes spinescent. It differs chiefly in the compressed pod being circinate or spirally twisted, coriaceous or fleshy and dehiscent, and the seeds often arillate or embedded in pulp.

1. *P. dulce*, Benth. Syn. *Inga dulcis*, Willd.

A pretty tree with small stipular spines persistent on the trunk. Leaves with only one pair of pinnae and these pinnae with only one pair of small oblique leaflets 1-2" long. Heads white '5" diam. in narrow panicles. Seeds 6-8 shiny black in a white pulpy aril.

It is often cultivated and deserves to be more so but I have not found it succeed on the Ranchi plateau and it is sensitive to frost. It is a native of Mexico. If repeatedly cut back it forms a good hedge and the pods serve as a cattle fodder.

Fl. Jan.-Feb. Fr. April-June.

12. ENTEROLOBIUM, Mart.

Differs from *Albizia* in the somewhat thickened fleshy pod which is more or less septate within. It is indehiscent.

1. *E. saman*, Prain. Syn. *Pithecolobium Saman*, Benth.; The Rain Tree.

A large or m.s. tree with rather short trunk but large spreading crown, often forked from the base. Handsome when in flower from the numerous rose-coloured heads of flowers with long stamens against the dark-green leaflets.

Very commonly planted in stations in every district. Native of tropical America. Fl. May-June. Fr. March-April. Evergreen.

Bark dark grey. Shoots and rhachis pubescent. Leaf rhachis with often a gland between one to all the pairs of pinnae, no gland at base. Pinnae 3-7 prs., lowest with 2-3 prs. of leaflets only, larger with 8-10 prs. Lfts. usually 1-2" long by '5-1", rhomboid with the costa diagonal, somewhat hairy beneath, esp. on the nerves. Peduncles 1-3-nate, 2-3" long, axillary, or appearing racemed from arising in the axils of very young leaves. Fls. distinctly pedicelled with a bract on the pedicel. Calyx '25". Corolla-tube rather longer, lobes '12". Filaments very long pink. Pod 5-9" fleshy with firm sutures.

A very easily grown tree of remarkably quick growth. The fuel is said to be useless (Mackenzie, *Fuel and Bamboo Plantations, Ind. For.*, 1917), but this may be due to the difficulty in splitting it. The tree is often much damaged by wind. The pods are sweet and are eaten by cattle.

The name is said to be derived from the multitudes of Cicadas which feed on the tree in the West Indies squirting out slender streams of fluid. The leaves give a good example of sleep movements. Mr. Maries, formerly of Darbhanga, found that this tree has the property of rendering *reh* soils fertile. I believe there has been no confirmation of this theory and possibly the efflorescence reappeared after the dense shade of the trees was removed.

FAM. 56. ROSACEÆ.

Herbs, shrubs or trees with stipulate alternate simple or variously compound leaves. Flowers regular, usually 2-sexual. Sepals imbricate in bud, sometimes an epicalyx present. Floral axis more or less hollowed out into a cupular or flask-shaped receptacle (hypanthium) lined above or entirely by the disc and bearing the sepals, petals and usually numerous, rarely definite, stamens. Carpels 1 to many, free or more or less adnate to the sides of the hypanthium, often entirely enclosed within it and when also connate forming with the latter a more or less syncarpous ovary. Ovules 1-2. Fruit very variable, sometimes of achenes free on the receptacle or nutlets sunk within it or sometimes forming with the fleshy swollen accrescent hypanthium a several-celled berry or pome.

- I. Carpels free, not enclosed in the hypanthium.
 - A. Carpel 1. Ovules 2, pendulous. Trees or shrubs.
Calyx 5-lobed. Petals large. 1. *Prunus*.
Calyx 5-toothed. Petals minute, sometimes sepaliform 2. *Pygeum*.
 - B. Carpels many, exposed in fruit.
 1. Ovules 2 collateral, pendulous.
Usually prickly shrubs 3. *Rubus*.
 2. Ovule solitary, ascending. Herbs.
Ripe carpels seated on the fleshy accrescent receptacle 4. *Fragaria*.
Ripe carpels seated on a dry receptacle 5. *Potentilla*.
- II. Carpels many 1-ovuled free at the bottom of a flask-shaped hypanthium, styles free or connate above. 6. *Rosa*.
- III. Carpels definite 2-ovuled, enclosed in the hypanthium and adnate to its walls, more or less connate with one another to form a syncarpous ovary. Fruit a berry or pome.
Flowers panicled 7. *Eriobotrya*.
Flowers fascicled or corymbose 8. *Pyrus*.

1. PRUNUS, L.

Trees or shrubs with simple entire or toothed, often gland-serrate, leaves with frequently 2 glands on the petiole. Fls. solitary fascicled corymbose or racemose. Sepal 5 deciduous in fruit. Petals conspicuous. Stamens perigynous. Carpel 1 with terminal style and 2 collateral pendulous ovules. Fruit a drupe, stone often 2-valved, 1-, rarely 2-seeded.

- A. Leaves conduplicate in bud, lanceolate.
Fls. peduncled appearing before the leaves 1. *amygdalus*.
Fls. sessile, appearing with new leaves 2. *persica*.
- B. Leaves convolute in bud, ovate acuminate 3. *armeniaca*.

1. *P. amygdalus*, *Baill.*, is the Almond.

3. *P. armeniaca*, *Benth. & Hook. f.*, is the Apricot. Neither appear to thrive in our area.

2. *P. persica*, *Benth. & Hook. f.* The Peach.

A small tree with oblong-lanceolate or oblong-oblong-lanceolate leaves 4-6" long finely serrate or doubly-serrate, short petioles and with fimbriate stipules. Flowers sessile on the brachlets, pink. Fruit velvety.

Succeeds well on the Ranchi plateau.

The variety with a smooth shiny fruit is the *Nectarine*.

Plums and Cherries are species of *Prunus* and have no connection with the Jujube or Ber commonly called "*plums*" by Anglo-Indians.

2. PYGEUM, Gaertn.

Evergreen trees or shrubs with entire or toothed leaves, sometimes a pair of flat circular glands at the base of the blade. Stipules minute caducous. Flowers small racemose. Sepals minute 5-6. Petals 5-6, like the sepals or very small and villous. Stamens 10-40, often in series of 10. Carpel 1 with 2 collateral pendulous ovules, sometimes abortive. Fruit a transversely ellipsoid somewhat didymous drupe with scanty flesh, cotyledons hemispheric, fleshy, albumen 0.

Leaves entire. Stamens over 30	:	:	:	:	:	:	1. <i>acuminatum</i> .
Leaves toothed. Stamens 10-15	:	:	:	:	:	:	2. <i>lucidum</i> .

1. *P. acuminatum*, Colebr.

A small evergreen tree with coriaceous elliptic or oblong acute or shortly acuminate leaves 4-6" by 1.5-3", yellowish-green flowers in racemes 2-5" long and transversely ellipsoid-oblong drupes .75" diam.

Along streams in the moist shady hill valleys of the Saranda forests! Very rare, but would probably also be found in the Mayurbhanj mountains. Fl. Aug. Fr. April-June.

Twigs brown with white lenticels. Leaves shining, some ovate, base rounded or shortly acute, mid-rib very prominent and sec. n. 6-8 strong beneath, arched, and looping some way from margin, cross tertiaries faint; glands present or not (on the same tree). Petiole .5" grooved above. Rhachis of raceme pubescent. Pedicels .25". Calyx .12" diam. pubescent. Fr. .5" on the shorter diameter, sometimes with a slight median vertical furrow, endocarp thin woody, testa papery veined.

2. *P. Andersoni*, Hook f. Syn. *P. lucidum*, Anders. (Beng. Pl.).*

A rigid shrub or small tree somewhat resembling a *Symplocos*, quite glabrous except the margins of the petals. Leaves coriaceous oblong or oblong-lanceolate obtusely acuminate, 1.5-3.5" with rounded sub-acute or obtuse base and crenate-serrate margins, sec. n. 8-12, faint, nearly straight, bifurcate. Petiole .3". Racemes 1" dense-fl. Pedicels very short. Hypanthium hemispheric, glabrous, sepals broadly ovate obtuse, petals twice as long, elliptic with densely ciliate margins. Stamens 10-15 with transversely oblong 2-celled anthers.

An interesting and very rare plant first collected by Anderson on Parasnath elev. 4300 ft. from a solitary tree on the northern side of the Central Peak. Since that collected several times, but only from the same locality and perhaps the same tree.

The tree has also been found at Mahendragiri, Ganjam, elev. 4500 ft. by Gamble and Fischer.

Fl. and renews its leaves in November. Fruit not seen.

3. RUBUS, L. Raspberry.

Rambling prickly shrubs, rarely creeping herbs. Leaves simple or lobed or compound, stipules free or adnate to the petiole. Flowers

* The name *P. lucidum* was published without description in Anderson's paper on the Flora of Behar and the mountain Parasnath.

terminal and axillary panicles, rarely solitary. Sepals persistent. Petals 5. Stamens many, inserted on the margin of the hypanthium or broad calyx-tube. Carpels many on a convex receptacle, style sub-terminal. Ovules 2 collateral, pendulous. Fruit of many 1-seeded drupels on the dry or spongy raised receptacle.

Leaves palmately 5-7-lobed : : : : : 1. *moluccanus*.
Leaves pinnately 3-foliolate : : : : : 2. *ellipticus*.

1. *R. moluccanus*, L. Syn. vide note.*

A shrub, easily recognisable as a Raspberry, with sarmentose prickly branches 3-5 ft. long, broadly ovate or sub-orbicular cordate lobed leaves with small prickles on the 5-7 strong primary nerves beneath and very dense axillary and terminal panicles of white rather inconspicuous flowers 5" diam. Fruit variable in size, scarlet fleshy.

Along the Pendra Valley, below Neterhat, elev. 3000 ft. Fl. Aug.-Oct. Fr. Sept.-Oct. Evergreen.

A very variable plant of which only the local form is here described. Branches tomentose. Leaves mostly 6 by 5.5" with rounded dentate lobe hoary-tomentose between the nerves and hairy on the nerves. Panicles usually only 2-2.5" long with lacinate stipules and bracts. Sepals acuminate reflexed in flower, erect 5-6" long after flowering. Petals distant obovate 2" long.

The fruit is insipid.

2. *R. ellipticus*, Smith.

A large sarmentose shrub with branches 15 ft. long, long-hirsute with spreading red sub-setose hairs and with a silky-tomentose under-layer. Leaves pinnately 3-foliolate, petiole and rhachis hairy like the twigs. Lfts. usually elliptic 2-4" long with an appressed hoary tomentum between the hairy nerves beneath and often small prickles along the mid-rib. Panicles small many-flowered with short pedicels and setaceous bracts. Flowers 3-5" diam. with obovate petals exceeding the calyx. Fruit a yellow raspberry 6" diam., very sweet.

Sameshwar Hills, Champaran, elev. 2500 ft. Meghasani, Mayurbhanj, near rivers, elev. 3500 ft. Fl. Feb.-March. Fr. April-May. Evergreen.

The leaflets are usually rounded or obtuse at the apex, the Mayurbhanj form has them gradually acute, margin very sharply toothed, sec. n. 8-12 strong, often bifurcate near margin, tertiary scalariform. Petiole 1-3". Stipules setaceous. Sepals acuminate. Carpels silky.

The fruit is good eating.

4. *FRAGARIA*, L. Strawberry.

Perennial stoloniferous herbs with digitately 3-5-foliolate leaves and stipules adnate to the petiole. Flowers white or yellow, often polygamous. Calyx with an epicalyx of 5 bracteoles, sepals 5 valvate. Petals 5. Stamens many persistent. Carpels many on a convex receptacle, styles ventral, ovule 1 ascending. Fruit of numerous achenes separately sunk in the very swollen fleshy receptacle.

* This is apparently *R. rugosus*, Sm., if the species is subdivided as is done in the *Flora of Madras*, but the bracts are rather variable though usually pectinate or incinate chiefly at apex. It cannot be variety *Thwaitesii*, which is described as having black fruit!

1. *F. indica*, Andr. Yellow-flowered Strawberry.

A delicate procumbent herb with long rooting stolons. Leaves about 2" diam. Leaflets obovate-cuneate with large lanceolate teeth which are sometimes again toothed, 7-1.5" long, thinly sericeous. Peduncles axillary, long and slender, only bearing 1 flower each which is yellow and about .5" diam. with calyx (including the epicalyx) exceeding the corolla. Fruit red.

Damp shady places, Purneah! Fl., Fr. Nov.-Jan.

Rootstock rather stout. Petioles very slender thinly villous. Stipules foliaceous toothed. Bracteoles of the epicalyx exceeding the sepals and sub-lobed or with 2-3 coarse teeth. Fruit sometimes very succulent but insipid, sometimes spongy.

2. *F. elatior*, Ehrh.

The cultivated strawberry, whose origin is probably *F. vesca*, L. (Hooker f.), succeeds fairly well on the Ranchi plateau. Fl. Feb.

5. POTENTILLA, L.

Perennial herbs, rarely shrubs, with compound leaves, stipules adnate to the petiole. Flowers usually yellow, sometimes white or red, sometimes unisexual or dioecious. Calyx 5- rarely 4-sepalous with an epicalyx of as many bracteoles, valvate. Petals as many. Stamens many, rarely definite. Carpels many, rarely definite, on a small receptacle which remains dry and does not become succulent in fruit, style ventral or terminal. Ovule 1 pendulous. Fruit of numerous achenes on the dry receptacle.

- A. Flowers in sub-corymbose cymes.
Diffuse. Radical leaves digitately 3-5-foliolate . . . 1. *Kleiniana*.
Erect. Radical leaves pinnately 5-9-foliolate . . . 2. *Leschenaultiana*.
B. Flowers solitary axillary.
Sub-erect or diffuse. Leaves pinnately 5-9-foliolate . . . 3. *supina*.

1. *P. Kleiniana*, W. & A.

A diffuse or sub-erect annual or perennial herb with weak stems often 18" long. Radical leaves long petioled digitately 3-5-foliolate, lfts. elliptic obovate 7-2" thinly hairy. Cauline leaves smaller and with shorter petioles upwards, 3-5-foliolate, obovate-cuneate, deeply serrate. Fls. 3" diam., yellow in corymbs 2-6" diam. Receptacle glabrous somewhat swollen or fleshy in fruit. Achenes 1 mm. long, oblique, keeled and with wavy ridges, glabrous or nearly so.

Highest hills of Ranchi and Palaman in grass near streams, Neterbat! Fl. April-June (perhaps all the r.s.).

Petioles laxly pilose, leaflets deeply sharply serrate except at the cuneiform base, with strong very oblique nerves, hairy. Leaves below the inflorescence sessile. Stipules 3-4". Sep. oblong-lanceolate, bracteoles of epicalyx rather shorter than sepals sometimes bifid. Pet. obovate 15". St. about 20.

Distrib. Himalayas and Khasia hills and mountains of Burma, S. India and Ceylon.

2. *P. Leschenaultiana*, Ser. Var. *biharensis*, Haines.

An erect villous herb with woody rootstock, long-petioled pinnate radical leaves with 5-9 alt. orbicular broadly-elliptic or obovate leaflets 7-1.8" long with a subsidiary leaflet between or at the base

of several of the leaflets, cauline leaves pinnate, 3-foliate or uppermost simple. Fls. yellow '4-5" diam. in lax often corymbose cymes about 2" diam. Achenes glabrous obliquely ovoid somewhat compressed with a dorsal rib and lineolate faces, on a conical sparsely villose receptacle.

Mountains of Chota Nagpur near streams. Neterhat 3000 ft.! Fl., Fr. May-July.

Radical leaves with petiole 6-8" long, leaflets villous beneath strongly nerved, a nerve running into each of the large strong mucronulate teeth. Stipules large, foliaceous. Pedicels slender. Sep. ovate '15". Bracteoles lanceolate nearly as long. Pet. obovate slightly retuse.

Distrib. (of type) North-West Himalaya and Nilghiri Hills.

3. *P. supina*, L.

An annual herb 3-4" and sub-erect, or with stems up to 1 foot very numerous and spreading from the root, hairy and leafy. Radical leaves (with petiole) 2-3" flaccid, often absent when flowering, pinnate, with 5-7 rarely 9 obovate opp. and alt. lobulate leaflets '2-5", lower cauline similar to the radical leaflets long-petioled, upper cauline with 3-5 leaflets short-petioled and lfts. usually small and obtuneate about 3-lobulate or incised-serrate. Fls. small yellow '25" diam., solitary axillary never corymbose, but often crowded on the repeatedly branched stems with much reduced leaves.

Northern tract, in damp places, Bettiah to Purneah (Malda, C. B. Clarke!). Fl., Fr. c.s., also Feb.-April. Leaflets not always distinct.

6. *ROSA*, L. Rose.

Erect, sarmentose, or climbing usually prickly shrubs with pinnate leaves and serrate leaflets, stipules adnate to the petiole. Flowers terminal, solitary or corymbose. Hypanthium ovoid or pitcher-shaped with a contracted mouth bearing the foliaceous or sub-foliaceous sepals which are imbricate in bud. Petals normally 5, large. Stamens many inserted on the thickened disc at the throat of the hypanthium. Carpels many, rarely few at the base of the hypanthium, free, but their styles sometimes connate above, stigmas thickened, ovule 1 (rarely 2) pendulous. Fruit of dry coriaceous or bony indehiscent carpels (achenes) enclosed in the fleshy hypanthium which is often lined with hairs.

A concise and admirable summary of the roses usually cultivated in India is given in Brandis's *Forest Flora of North-West and Central India*. This is reproduced with some modifications in the *F.B.I.* The following appears to be the only rose indigenous in our area.

1. *R. involucrata*, Roxb. Jangli Gulab, H.; Koya, Vern. (Bihar, teste Ham.).

A pretty shrub, sometimes subscandent with arching branches. Pinnate leaves with 5-11, usually 7-9, small elliptic-lanceolate or elliptic-oblong lfts. '25-1'25" long, finely sharply serrate. Flowers 2" diam. pure white solitary or in short corymbs.

Northern Tract, said to be common along the rivers. Purneah! "In the Central and Southern tracts it is rare, but found along the larger rivers in the forest tracts, Singbhum! Daspalla! Buch. Ham. says that it was common in the "higher parts of the swamps of Purneah" (Puraniya, *cide* unpublished MS.). Fl. March-April.

Young parts and inflorescence tomentosely villous, gradually glabrescent.



57. SAXIFRAGACEÆ.

[1. VAHLIA.]

Leaves 2-4" long only, lfts. shining, stipules with very narrow segments. Styles distinct, ending in a discoid mass of stigmas. Fruit globose, tomentose (not seen by me), the sepals deciduous.

7. ERIOBOTRYA, Lindl.

Trees with simple coriaceous leaves and white flowers in dense panicles. Sepals small persistent on the turbinate or clavate hypanthium. Petals 5 contorted or imbricate, obovate or orbicular. Ovary 2-5-celled with styles connate and woolly below. Ovules two in each cell, basal, ascending. Fruit baccate with very thin endocarp and large angled seeds with very thick cotyledons.

1. *E. japonica*, Lindl. Loquat, Japanese Medlar.

A small tree with stout branchlets, leaves beneath and inflorescence densely woolly. Leaves large, 6-12" long, sub-sessile, lanceolate or oblanceolate acuminate, dentate or serrate with 15-20 strong sec. n. Flowers .5" diam. in dense stout panicles 3-6" long. Fruit ovoid yellow succulent 1-1.5" long, 1-5-seeded.

A native of Japan, frequently cultivated and succeeding well on the Ranchi plateau and in the Northern Area. Fl. Sept.-Oct. Fr. March-April.

An excellent fruit.

Pyrus communis, L. The common Pear is cultivated on the Ranchi plateau but yields a fruit only fit for cooking.

FAM. 57. SAXIFRAGACEÆ.

Trees, shrubs or herbs with alt. or opp. nearly always simple leaves stipules sometimes adnate, always exstipulate when opposite. Flowers regular. Sepals imbricate or valvate usually on a distinct hypanthium which varies much as in the Rosaceæ, from which family the alternate leaved genera are separated chiefly by habit, by the definite stamens equal to or double the number of the petals, ovary of 2-5, commonly 2, free or connate carpels but usually united below and often forming a 1-celled ovary below, and by the numerous ovules and seeds. Placentation in 1-celled ovaries is parietal or the placentæ are pendulous, in 2-more-celled ovaries axile. The opposite-leaved genera often have numerous stamens.

Our only representative (indigenous) genus is not at all typical. To the family also belongs the *Hydrangea*, which is often cultivated.

1. VAHLIA, Thunb.

Herbs with opposite entire exstipulate leaves, but sometimes with a stipular line. Flowers axillary, usually paired. Sepals 5 superior persistent. Petals 5 and st. 5, epigynous. Ovary inferior 1-celled with 2 pendulous placentæ and many ovules, styles 2. Capsule dehiscent apically between the styles. Seeds numerous, minute, ellipsoid, smooth.

Peduncles 3-7", 2-fld. Filaments without basal scale . . . 1. *oldenlandioides*.
Flowers sub-sessile. Filaments with a minute basal scale . . . 2. *viscosa*.

1. *V. oldenlandioides*, Roxb.

A small plant very like an *Oldenlandia*, usually erect or diffuse, much branched about 6" high, shortly sparsely pubescent all over and also

glandular above. Leaves 5-2", subsessile, linear to linear ovate. Peduncles 2-fld. in all the axils, 3-7" long. Fls. white (or yellow?) with 5 small erect triangular sepals, petals about 17" long, obovate. Capsule sub-globose 12" diam.

In fields. Behar, Kurz! Puri! Fl., Fr. c.s.

2. *V. viscosa*, Roxb.

Densely branched from the root with stems up to 10" and even more densely flowered than the last, glandular-pubescent. Leaves 5-1" long sub-sessile, ovate to lanceolate, narrowed both ends. The flowers are sub-sessile (peduncles up to 1") and the filaments have a minute hairy scale at the base which is absent in the last.

Dry rice-fields. Fl. Feb. On grounds of distribution probably occurring in our area.

There are frequently axillary branches congested in the leaf axils which makes the resemblance of this genus to the *Rubiaceæ* the more striking.

FAM. 58. CRASSULACEÆ.

Herbs, rarely undershrubs, usually with simple (exc. *Bryophyllum* and *Kalanchoe*) alternate or opposite fleshy exstipulate leaves and regular racemose, cymose or paniced flowers. Sepals and petals usually 4-5, free or gamophyllous. Stamens hypogynous or epipetalous, as many as or twice the petals. Carpels as many as petals, rarely only 3, free or connate below, narrowed upwards into distinct styles. Hypogynous glands or scales sometimes present at the base of each. Ovules on the edges of the carpels, usually many. Fruit follicular; seeds albuminous with terete embryo and short cotyledons.

Calyx with long inflated tube and 4 short lobes 1. *Bryophyllum*.
Calyx 4-partite 2. *Kalanchoe*.

1. *BRYOPHYLLUM*, *Salis*.

Erect perennial herbs with opposite simple or 3-partite crenate leaves. Flowers large drooping, in panicles with opposite spreading branches. Calyx large inflated, shortly 4-lobed. Corolla gamopetalous with short 4-fid limb. Stamens 8, 2-seriate, inserted on middle of the corolla tube. Hypogynous scales 4. Carpels 4, free or connate at base, ovules very many. Follicles 4, many-seeded.

1. *B. calycinum*, *Salis*. Kop-pata, Beng.; Life-plant.

A glabrous fleshy herb with simple or 3-foliolate (at base) leaves, oblong or elliptic crenate or very coarsely crenate leaflets 2-6" long and flowering stems 1-3 ft. high bearing a panicle of pale greenish and purple flowers with inflated campanulate calyx 8-15" long with 4 deltoid lobes. Corolla nearly included, sub-globose at base and constricted in middle, tip reddish purple. Follicles included in the persistent perianth.

Frequent in Orissa in rocky waste ground on the edges of streams! Very commonly cultivated and sometimes spreading as an escape. Fl. Dec.-Feb.

The plant is remarkable by the facility with which it produces buds and young plants from the leaf-crenatures when these are laid on damp ground. Young plants will even form in the botanical drying press and sometimes grow an inch in length before dying.

2. **KALANCHOE**, *Adans.*

Erect stout usually fleshy perennial herbs with opposite leaves, or the upper alternate, lower or all sometimes pinnate or pinnatifid or 3-foliolate. Flowers large usually yellow with calyx deeply divided and corolla with a spreading limb above the gamopetalous flask-shaped tube, much exceeding the calyx. Stamens 8, 2-seriate, adnate to corolla-tube. Scales 4. Carpels 4, rarely 5, adnate to base of corolla. Ovules many. Follicles 4.

Leaves simple obovate-elliptic, crenate 1. *heterophylla*.
 Leaves, or some of them, deeply pinnatifid 2. *laciniata*.

1. **K. heterophylla**, *Prain*. Syn. *K. floribunda*, var. *glabra*, *F.B.I.*;
 Cotyledon *heterophylla*, *Roxb.*

About 1-3 ft. high when in flower, with opposite fleshy ovate oblong, or upper elliptic, leaves 2-3" long which are crenate or (fide *Roxburgh*) slightly laciniate. Fls. clear yellow (white or pale-pink, *C. B. Clarke*) in compound corymbose glabrous cymes with numerous small lanceolate bracts 12" long. Sepals oblong acute. Corolla-tube 3-4" long, lobes 2-25" lanceolate.

Parasnath, elev. 4000 ft., *J.D.H.*! Fl. April.

The young plants have sometimes ternate leaves. Petiole short.

2. **K. laciniata**, *DC.*

Sometimes almost woody below 1-3 ft. high when in flower with the lower and sometimes all the leaves pinnatifid with very narrow usually entire lobes or (at least in cultivation) 2-3-pinnatifid. Fls. bright yellow 1" diam. in paniced cymes, sepals lanceolate, glabrous or pubescent.

Patna, *C. B. Clarke*. But it is so commonly cultivated and so easily spreads that I think this was probably not indigenous.

FAM. 59. DROSERACEÆ.

Small herbs usually with whorled radical leaves and cauline leaves alternate or 0, copiously covered with long glandular hairs secreting fluids by means of which they catch and digest minute insects, sometimes diaphanous and glabrous and then with automatically closing laminae. Flowers small regular axillary or on slender scapes. Calyx 4-8-partite or sepals free. Petals and stamens as many as the sepals, hypogynous or very slightly perigynous. Ovary nearly free 1-3-celled with 5-3 styles. Ovules many on parietal placenta equal in number to the styles. Capsule membranous 5-3-valved, many-seeded. Seeds many with fleshy albumen, embryo cylindric or minute.

Leaves glandular, cauline 0 or alternate 1. *Drosera*.
 Cauline leaves whorled vesicular glabrous 2. *Aldrovanda*.
 (**Aldrovanda* has been found in salt pans south of Calcutta close to but not within our area. It is not further dealt with.)

1. **DROSERÆ**, *L.* Sundew.

Small green or red herbs usually found in wet places with small rosettes of radical leaves or with erect or decumbent leafy stems with alternate leaves which are usually circinate in veneration. Stipules



Cor adnate to petiole. Sepals persistent. Petals white or rose, marcescent. Stamens hypogynous or slightly perigynous. Ovary 1-celled with 2-5 styles. Fruit loculicidally 2-5-valved. Seeds many obovoid ellipsoid.

Leaves forming a close rosette, stem 0	1. <i>Burmanni</i> .
Stem elongate with linear leaves	2. <i>indica</i> .
Stem with lunate peltate leaves	3. <i>peltata</i> .

1. **D. Burmanni**, Vahl. Mukha-jali, H.

A pretty little plant with a very close compact rosette of obovate or orbuncate leaves '25-4" covered with (usually scarlet) gland-hairs. Scape erect 3-8" high, sometimes forked. Flowers rose-pink or white secund in a helicoid cyme, usually only one or few opening at a time. Pedicels erect in fruit. Calyx reddish covered with short papillæ.

Locally abundant, especially in Purneah! Also found in Chota Nagpur! Generally on damp sandy ground where water has stood during the monsoon but sometimes (in Purneah) on rather high ground. Fl. Nov.-April.

The stipules in *F.B.I.* are said to equal half the petiole. Those in my specimens are as long as or exceeding the petiole, shortly adnate and intrapetiolar with long fimbriae.

2. **D. indica**, L. Linear-leaved Sundew.

A slender little plant with sub-erect or decumbent weak stems a few inches long with linear leaves 1-2" long covered with long gland-tipped hairs. Flowers larger than in the last '5" diam. with long pedicels '3" long in helicoid cymes 2-4" which are usually lateral on the stem (not radical but probably terminal, the branching being cymose). Pedicels spreading in fruit. Sepals lanceolate '15-2" thinly gland-hairy.

Frequent in wet ground near tanks and river-beds. Chota Nagpur, common! Purī! Probably in all districts, ascending to top of Parasnath. Fl. Sept.-Jan.

3. **D. peltata**, Sm., is said to occur throughout India, but I have seen no specimens from our area. It is a hill plant and might be found at Neterhat.

FAM. 60. HALORRHAGIDACEÆ.

Small terrestrial herbs (excluding South American genera) or aquatics with opposite or whorled, or upper alternate, simple or (in aquatic species) pectinately-pinnatisect exstipulate leaves. Flowers reduced, solitary or clustered axillary or by reduction of the leaves running out into spikes, 1-2-sexual. Calyx lobes 4 or 0. Sepals and petals 4 or 0 superior. Stamens 8, 4 or reduced to 1, epigynous. Ovary 4-, 2- or 1-celled with a like number of simple or fimbriate styles. Ovules 4 altogether, pendulous. Fruit small dry or drupaceous, indehiscent or separating into its carpels.

Stamens 4. Leaves submersed whorled often pinnatisect	1. <i>Myriophyllum</i> .
Stamen 1. Submersed leaves entire opposite, floating pseudo-whorled	2. <i>Callitriche</i> .

[*Callitriche* is shown here in the place allotted to it in the genera *Plantarum*. It has, however, already been dealt with next to the *Euphorbiaceæ*. It has 1-sexual flowers, and whether the ovary is superior or inferior it is not possible to say.]

61. RHIZOPHORACEÆ.

1. MYRIOPHYLLUM, L.

Slender aquatic herbs with the submerged leaves whorled or rarely upper alternate, submerged ones usually finely cut into capillary segments, exserted ones toothed, rarely all simple and toothed or entire. Fls. inconspicuous axillary or in spikes appearing above the water. 1-2-sexual. Sepals 4, rarely 2 or 0 on a short tube in the male, hypanthium longer and 4-furrowed in herm. fl. or fem. fl. Petals 2-4 concave, sessile. St. 2, 4 or 8 in male, sometimes 0 in female. Ovary inferior 4- rarely 2-celled. Fruit 4-furrowed sometimes separating into 4 or 2 cocci. Seeds albuminous with central terete embryo.

- Flowers white or pink with much fimbriate stigmas, carpels with acute dorsal ridges 1. *tuberculatum*.
 Flowers white, stigmas slightly fimbriate, carpels rounded on back. 2. *indicum*.

1. *M. tuberculatum*, Roxb.

A submerged aquatic with lower leaves 1-1.5" long cut into filiform segments and somewhat leafy spikes of minute flowers 3-5" long, often lateral as well as terminal, floral leaves simple linear-oblongate toothed .25-.5" long. Upper fls. male, lower female, but sometimes hermaphrodite fls. also present. Petals white, stamens 4 with yellow anthers. Stigmas pink very fimbriate. The plant in fruit is easily recognised from the 4 radiating sharply angled tuberculate carpels, the whole fruit about .1" long and broad.

Probably generally distributed. Fl., Fr. Sept.-Dec.

2. *M. indicum*, Willd.

Habit of preceding except that the plant is much more flaccid and leaf segments more capillary so that the plant collapses into a tassel when taken from the water. Floral leaves usually very short .1-.2" long, rarely .3" long narrow lanceolate toothed. Spikes dense at the top. Fls. .04" long. Fruits .08" diam. 4-lobed, the lobes with rounded angles, not or scarcely tubercled.

Bengal, J.D.H.Y. Herb. Ham. (without locality, possibly Purneah)! There are no good specimens from our area though it almost certainly occurs, especially in Orissa.

Fl., Fr. July-Sept.

FAM. 61. RHIZOPHORACEÆ.

Trees or shrubs, often littoral and furnished with pneumatophores (sometimes called blind root-suckers) and aerial roots, generally glabrous with opposite entire simple coriaceous leaves and interpetiolar deciduous stipules which enclose the terminal bud and leave prominent scars. Flowers regular, 2-sexual, often coriaceous, on 1-many fld. axillary peduncles. Calyx superior or half-superior on a cupular or campanulate hypanthium, 4-14-lobed or -sepalous. Petals as many, often 2-fid and laciniate. Stamens twice as many, rarely indefinite, perigynous or epigynous. Disc usually lining the hypanthium above the ovary which is inferior or free, 2-5- rarely

1-celled. Ovules 2 pendulous in each cell or pendulous from a central placenta in 1-celled ovaries, style 1. Fruit usually a coriaceous 1-seeded berry (tardily dehiscent in *Weihea*). Seed usually albuminous but albumen quickly absorbed by the growing embryo, rarely arillate. Embryo usually without a period of rest but germinating on the tree, in other cases minute. Cotyledons either fused or distinct, sometimes 3-4.

The Mangroves are usually distinctly xerophytic, the salt water being a physiologically dry environment, and the leaves often bear water-tissue below the epidermis. The pneumatophores as well as the stilt-roots and aerial roots have numerous large lenticels and air-conducting tissue to supply oxygen to the submerged parts.

In aerial germination the cotyledons at first enlarge in some cases but this growth is quickly superseded by that of the hypocotyledonary axis or tigellus which may attain 1-3 ft. in length while still on the tree. On falling it plunges deep into the soft mud either bearing with it the cotyledons (*Bruguiera*) or separating circumscissilely from the fused cotyledonary body.

Dots in the leaves are due to cystoliths of Calcium Oxalate.

- I. Flower epigynous, the ovary completely adnate to the hypanthium (before pollination). Fruit indehiscent.
 - A. Hypanthium flask-shaped, not or scarcely produced into a limb above the ovary. Calyx girding the fruit, 4-6-sepalous.
 1. Sepals 4. Petals entire. Anthers many-locellate. 1. *Rhizophora*.
 2. Sepals 5-6. Petals lobed or cut. Anthers 4-celled. Stamens 10-12. Ovary 3-4-celled 2. *Ceriops*.
 - Stamens indefinite. Ovary 1-celled 3. *Kandelia*.
 - B. Hypanthium spherical or tubular produced above the ovary. Calyx above the fruit, 5-14-sepalous.
 - Sepals 8-14. Petals embracing the stamens. 4. *Bruguiera*.
 - Sepals 5-8. Petals not embracing the stamens 5. *Carallia*.
- II. Flower perigynous, the ovary free in the hypanthium 6. *Weihea*.

1. RHIZOPHORA, L. Mangrove.

Evergreen trees or large shrubs with little main trunk and numerous stout usually arched adventitious roots. Leaves coriaceous mucronate or apiculate. Fls. rather large, coriaceous, on axillary few flowered bracteate cymes. Sepals 4. Petals 4 entire. Stamens subsessile with many-celled anthers inserted on the fleshy margin of the hypanthium. Ovary 2-celled produced beyond the adnate hypanthium as a cone, stigma 2-fid. Ovules 2 in each cell. Fruit ovoid girt with the persistent sepals. Albumen present before germination. Cotyledons fused and acting as a continual absorber of nutriment for the largely elongating hypocotyl which ultimately grows far beyond the fruit and is club-shaped. The upper end with the small plumule finally detaches itself circumscissilely from the cotyledonary mass and drops into the mud.

True specialised pneumatophores are generally absent, their function being assumed by the upper part of the stilt-roots which is copiously supplied with lenticels and air tissue.

- Cymes long-peduncled 3-5 flowered 1. *mucronata*.
- Cymes very shortly peduncled with 2 subsessile flowers 2. *candelaria*.

1. *R. mucronata*, Lamk. Rai, Or.; The Common Mangrove.

A handsome small tree standing on stilt roots, with elliptic or broadly elliptic coriaceous leaves 4-6" long cuneate both ends and

tipped with a short blunt awn, brown or black dotted beneath and also microscopically pale-punctulate. Flowers in long-peduncled few-fld. cymes, very coriaceous, '4-7" long. Fruit brown at time of germination 1.5-2", obpyriform.

Orissa, tidal swamps of the Mahanadi delta! Fl. Dec. also April-June. Evergreen.

Bark smooth. Blaze pink. Branchlets closely marked with leaf and stipular scars, leaf buds subterete slender 1.5-2.5". Petioles '6-1.5". Peduncles on the young branches, usually only 3-flowered, 1-1.5" long. Fls. yellowish, pedicelled, cyme branches and pedicels each with two terminal bracteoles united by their bases. Calyx split 1/2 to the base of the flower, sepals broad-lanceolate. Petals fleshy woolly on the inner face. Anther's leathery apiculate with an oblong-lanceolate basi-fixed ligule covering the locellæ.

Fruit with the reflexed sepals '4-5" long, the germinating tigellus and radicle reaching one foot or more before dropping.

One year old seedlings (communicated by Mr. C. G. Rogers) are 3-4 ft. long with the lower part '6" diam. warted with large lenticels and 3-4 pairs of narrow elliptic leaflets. I have a note of numerous slender erect pneumatophores in this species.

The bark is largely used for tanning.

2. *R. candelaria*, DC. Syn. *R. conjugata*, F.B.I. (not of Linn.); Rai, Or.

A tree very similar in general appearance to the last but distinguished in the forest by its narrower leaves which are often subacuminate. Peduncles very short and stout bearing two subsessile flowers only. Fruit narrower, the 4 reflexed sepals oblong '4-5" long.

Orissa, tidal forests of the Mahanadi delta! Mr. Rogers points out that in Burmah and elsewhere this tree is usually found in less deep water than *R. conjugata* in association with the *Bruguieras* and has therefore less stilted roots. Fl., Fr. April-June and perhaps at other times.

Petiole '5-1", often rather shorter and stouter and the sec. n. more distinct than in *R. mucronata*. Peduncles mostly from the axils of fallen leaves '2-35" long, bracteoles forming a cup receiving the base of the '5" long flower. Petals thin, glabrous.

Bark used for tanning as in the case of *R. mucronata*. The one-year seedling has elliptic-lanceolate leaves and the lower part is far less warted or nearly smooth as compared with *R. mucronata*.

(The unfortunate change of name appears necessary, vide *Kew Bulletin*, 1920, p. 51.)

2. CERIOPS, Arn.

Small trees or shrubs with ovate or obovate leaves and small flowers in axillary peduncled heads with bracts and bracteoles at their base. Sepals 5-6, petals 5-6. Stamens in two whorls, diplostemonous, filaments inserted between the lobes of a crenate disc. Ovary with free top only, growing up in fruit far beyond the calyx-tube which girds its base, 3-celled, cells 2-ovuled. Fruit 1-celled and -seeded. Germination as in *Rhizophora*.

1. *C. Roxburghiana*, Arn. Goran, Beng.; Gartah, Or.

A tall shrub or a small tree with many upright branches, coriaceous obovate rounded leaves mostly 2-3" and small greenish-white sessile flowers in short-peduncled heads. Flowers each with a brown-edged bract and 2 bracteoles at base. Sepals 4-6. Petals 4-6 shorter oblong puberulous or pubescent with white fimbriate margins.

Stamens 8-10 (10-12, *F.B.I.*) inserted outside the crenate disc. Fruit 5-6" girt by the calyx about one-third from base.

Orissa, tidal forests of the Mahanadi delta! Fl., Fr. April-May.

With numerous pneumatophores. Blaze white, turning brown. Leaf buds compressed linear 1". Leaves sometimes up to 4" by 2", base cuneate on the 4-1" long petiole. Peduncles 1-3". Sepals 2" thick fleshy lanceolate acute 3-angular. Petals conduplicate embracing the inner whorl of stamens. Ovary at first with free top only, ultimately growing up conically far beyond the calyx tube as in *Kandelia*. Germinating embryo 4-5" before dropping, often curved, seedling leaves narrowly obovate.

3. KANDELIA, *W. & A.*

A small tree with oblong coriaceous leaves and moderate-sized white flowers in long-peduncled cymes. Fls. sheathed at base by connate bracts. Hypanthium turbinate produced above the ovary and with an annular disc within. Sepals 5-6 linear. Petals 2-fid with multifid lobes. Stamens numerous. Ovary 1-celled, conical tip growing out in fruit beyond the calyx. Ovules usually 5 abortive and 1 fertile on a central column. Fruit 1-celled and -seeded.

The germination is said to be as in *Rhizophora* but I have not examined it. The germinating seedling may attain 1 foot in length before falling. The first stem is bifurcate (always?).

1. *K. Rheedii*, *W. & A.* *Rasunia*, *Or.*; *Goria*, *Beng.*

A small spreading tree with thick twigs, leaves 4-5" long rounded at the apex and white flowers with white linear sepals 5-6" long. Petals caducous. Fruit 1" long, a double cone girt by the calyx at their common base.

Orissa, tidal forests of the Mahanadi delta, usually fringing the creeks and leaning over the water! Fl., Fr. all the year round. Evergreen.

Leaf buds flat linear with stipules 1". Leaves tapering into the 3-7" long petiole, microscopically dotted beneath, sec. n. not visible. Peduncles 1-1.7" long, usually once bifurcate and each branch with 2 pedicelled flowers, sometimes twice branched. Hypanthium turbinate-campanulate, sepals finally reflexed.

4. BRUGUIERA, *Lam.*

Large or small trees with coriaceous leaves and rather large coriaceous flowers on 1-many-fld. peduncles. Sepals and petals 8-14 on the obconic, campanulate or ellipsoid hypanthium. Petals oblong 2-lobed with a bristle in the sinus, lobes sometimes fimbriate. Stamens twice the petals, embraced by them and springing elastically forward when ripe, filaments slender, anthers linear, mucronate. Ovary 2-4-celled inferior. Style slender, stigma minute, 2-4-lobed. Fruit girt by the calyx, 1-seeded.

The germination is said to be as in *Rhizophora* but it is only superficially so. There are 3-4 cotyledons, sub-connate while in the seed with absorbing tips in the gelatinous albumen. On protrusion of the radicle the style and its base is thrown aside as a cap, and when ripe for falling the whole embryo including the linear-oblong cotyledons falls. The latter not remaining behind and circumscissilely breaking off as in *Rhizophora*.

The *Bruguieras* are found in shallower water than the *Rhizophores* and often develop a large trunk.

Leaves elliptic, petioles over 1". Flowers solitary . . . 1. *Gymnorhiza*.
L. narrowly-elliptic, petiole under 1". Fls. 2-3 . . . 2. *caryophyllodes*.



B. conjugata, Merr., inc. *B. eriopetala*, W. & A. Syn. *B. gymnorhiza*, Lamk.; *Rhizophora conjugata*, L., non F.B.I.; Kekra, Rasinia, Or.

A small straight tree with elliptic, or sometimes somewhat elliptic-ovate, shortly acuminate leaves 3.5-5" with petioles 1-2.5" long, large solitary campanulate flowers 1-1.3" soon reflexed with the tube rather shorter than the 10-12 linear-subulate sepals. Petals 2-lobed .55" with a long bristle from the sinus and 0-3 shorter ones near the end of each lobe.

Orissa, tidal forests of the Mahanadi delta! Fl. April-June and perhaps at other times. Evergreen.

Bark grey, nearly smooth; blaze bright crimson. Stipules about 2-2.5" long, buds subterete. Brown dots on the leaf absent or very few. Sepals rarely 14, tube usually ridged.

I have united *B. eriopetala* with this species. Mr. Rogers agrees with me that it at most is no more than a variety.

α. conjugata proper. Petals villous on the margins at the base nearly glabrous above with 2-4 bristles on each lobe.

β. eriopetala, W. & A. sp. (*Wight Ill.*, i, p. 210). Petals densely villous along the whole margin with 0-1 bristle on each lobe. Intermediates may, however, occur with petals sparingly fringed throughout and more than 1 bristle on a lobe.

Occurs in same localities as the type.

The tigellus and radicle are much shorter than in the *Rhizophores*, being only about 6" long when the leafy shoot emerges. Mr. Rogers states that it is found in somewhat shallower water (in Burma).

2. B. caryophylloides, Blume. Kekra, Karika, Or.

A small erect tree with narrowly elliptic or lanceolate-obovate leaves 3-4.5" cuneate or shortly acuminate at apex and narrowed at base into a petiole .75-1" long. Flowers whitish 2-3 pedicelled on a short axillary peduncle, with ellipsoid-obconic tube .15-.2" long and erect or spreading sepals .15" long which soon become reflexed and enlarged to .3" and the tube to .4". Young embryo very early penetrating the top of the fruit which is at first below the top of the calyx-tube.

Orissa, tidal forests of the Mahanadi delta! Fl. April-June. Evergreen.

Leaf buds compressed at base, very acuminate, leaves microscopically dotted beneath, sec. n. not visible (when fresh), stipules 1.5". Peduncles .3" with two rather membranous deciduous bracts at the top .15" long. Pedicels shorter than petiole. Sepals and white petals 8, petals shorter than calyx, apex fimbriate. St. about 16. Fruiting calyx .4" somewhat urceolate crowned by the spreading or reflexed sepals.

Young embryo slender, not more than 4-5" long while on the tree.

5. CARALLIA, Roxb.

Trees or shrubs with entire or serrulate leaves and small greenish or white flowers sessile in short dense 3-chotomous cymes. Hypanthium minutely bracteate at the base and produced above the ovary with 5-8 sepals and a crenulate disc. Petals and stamens inserted on the margin of disc; petals clawed, orbicular or quadrate, small, 2-fid or entire. Filaments slender. Ovary 3-4-celled, style with 3-4-lobed stigma. Fruit small globose coriaceous, crowned by the calyx.

Leaves entire. Petals white 1. *integerrima*.
Leaves serrulate. Petals yellow 2. *lucida*.

1. *C. integerrima*, DC. Jur, K.; Kierpa, Beng.; Manj, Or.

A small tree with shining leathery oblong, elliptic or obovate shortly suddenly obtuse or obtusely acuminate leaves 3-6.5" long and stout dense 2-3-chotomous cymes 1-2" long of small greenish flowers with inconspicuous white erose petals. Fruit .25" diam.

Purneah! Singbhum, frequent along the banks of streams and dry nalas! Santal Par.! Athmallik! Angul! Sambalpur, along streams! Fl. Dec.-April. Fr. r.s.

Attains 5 ft. girth but no great height. Bark smooth grey, blaze hard red. Aërial roots sometimes present. Twigs somewhat 4-angled. L. sometimes 8" by 3", base often cuneate or attenuate, crystal-cells visible as dots, sec. n. close oblique, anastomosing within margin. Peti. .3-.5". L.-buds linear-lance. .5-.75" acuminate, enclosed by the caducous stipules. Peduncle .5-.75". Fls. obconic .17". Pet. 6-8, 2-fid. and lacerate

Wood hard and red, said to be good and useful for furniture, cabinets and veneering. Gamble gives weight as 46 lbs.

2. *C. lucida*, Roxb.

A specimen collected by me in Purneah with serrulate leaves exactly matching *C. lanceafolia*, Roxb., may be this. It is young with acuminate leaves, without flowers. Possibly a seedling of *C. integerrima*? Have these serrulate leaves?

6. WEIHEA, Spreng.

Trees or shrubs with oblong entire or obtusely serrate leaves. Flowers on 1-more-fid. peduncles with connate bracts enclosing the buds. Calyx 4-5-fid. patent, on a campanulate hypanthium with a low slightly lobed disc, under the margins of which the clawed spathulate fimbriate-lacerate petals are inserted. Stamens 16-30 inserted on the margin of the perigynous disc with slender filaments and oblong anthers. Ovary 2-4-celled with filiform style, stigma with 2-4 lobes. Ovules 2 in each cell. Fruit globose fleshy but tardily septically dehiscent into 2-4 valves, 2-4-celled each with 1-2 seeds. Seeds arillate, ovoid, subtrigonal with straight embryo and elliptic cotyledons.

1. *W. ceylanica*, Baill.

An erect much-branched shrub 3-4 ft. with lenticellate brown twigs and very coriaceous opaque oblong or ovate-lanceolate leaves 2.5-3.5" long shining above with obtuse tip and rounded or sub-obtuse base. Sec. n. 5-7 very slender. Petiole .2" pubescent. Stipules interpetiolar oblong obtuse erect or recurved .15" long, pubescent. Fls. solitary or geminate axillary shortly pedicelled, globose buds enclosed in 2 orbicular bracts which are nearly glabrous except at base and ciliate margins. Sepals 5 thick valvate densely silky ovate acute, shortly bearded within near the apex. Pet. 5 broadly ovate or quadrate pectinate nearly to the middle. St. 30 with very short filaments (in bud) and oblong 2-celled anthers with cells on the inner face. Ovary conical villose, style with 3 short stigmas.

Rocky margins of the Chilka Lake! Flower buds Dec.-Jan.

My specimens from which above description is taken are in very young bud; it is therefore not possible to give the measurements of the parts of the flower. The following details are from specimens outside the province; ours may possibly be a new species: it is 5-merous.

L. often acuminate, petiole up to .3". Fls. usually tetramerous. Sepals oblong

immature "2-25", spreading persistent. Petals cuneate. Anthers cordate. Ovary 3-celled. Fr. (f. *F.B.I.*) globose spongy. The plant in young bud looks very like one of the *Celastraceæ*, but the stipules at once give it away.

All specimens in the *Cal. Herb.* are from S. India and Ceylon.

FAM. 62. COMBRETACEÆ.

Trees or shrubs sometimes scandent, with opp. or sub-opposite, more rarely quite alternate simple exstipulate leaves often with small peltate scales beneath or dots due to cystoliths. Fls. generally small, sometimes polygamous, usually sessile in spikes, heads or in racemes. Hypanthium completely enclosing the ovary and often prolonged above it into a very narrow tube or beak carrying a wider tubular or campanulate 4-6-lobed "calyx-tube." Petals between the lobes, or often 0. Stamens 2-seriate, twice as many as the calyx-lobes or one series reduced or absent. Ovary completely inferior, 1-celled with few pendulous ovules. Style simple. Fruit 1-seeded, generally indehiscent, sometimes 2-5-winged or -angled. Seed exalbuminous, cotyledons usually large and convolute, sometimes three.

Germination appears always to be epigeal, the expanded cotyledons large and broad, often somewhat truncate at the tip and palminnerved, petioled.

Characteristic nervation of *Combretaceæ* is penninnerved with a number of rather strong sec. n. curved up with the margin and less strong or weak numerous obliquely scalariform tertiaries.

I. Fls. racemose or spicate. Staminodes not present.

A. Petals 0.

1. Trees. Sepals deciduous.

Fls. spiked or racemed. Fr. usually drupaceous

Fls. capitate. Fruit small dry

2. Large diffuse shrub. Calyx accrescent

B. Petals 4-5 (exc. *Combretum apetalum*).

1. Littoral shrub with alternate leaves

2. Terrestrial usually climbing shrubs.

Beak of hypanthium short or under "5"

Beak of hypanthium very long. Flowers showy

II. Fls. cymose. Staminodes present as glands

1. *Terminalia*.

2. *Anogeissus*.

3. *Calycopteris*.

4. *Lumnitzera*.

5. *Combretum*.

6. *Quisqualis*.

7. *Gyrocarpus*.*

1. TERMINALIA, L. Myrabolan.

Large trees with sub-opposite, opposite or alternate leaves sometimes clustered at the ends of the twigs and often bearing large glands on the petiole or base of the blade. Fls. small greenish in the axils of caducous bracts in simple or panicked spikes, 4-6-merous. Hypanthium not beaked above the ovary, bearing a campanulate limb or calyx-tube with a hairy lobed disc. St. diplostemonous inserted outside the disc. Ovules 2-3. Fruit drupaceous or dry, endocarp 4-5-angled, or pericarp produced into wings.

I. Fruit drupaceous, not winged.

A. Leaves alt. and clustered at the ends of the twigs.

Spikes simple.

Petioles very short. Fr. glabrous, compressed

Petioles 1". Fr. tomentose globose or pyriform

B. Leaves not clustered at the ends of the twigs. Spikes panicked.

II. Fruit with 5 (-4) sub-equal wings. Spikes panicked.

Bark pale. Leaves glabrous

Bark dark, rough. L. usually hairy or tomentose beneath

1. *catappa*.

2. *belerica*.

3. *chebula*.

4. *arjuna*.

5. *tomentosa*.

* Now transferred to Family Hernandiaceæ.

1. **T. catappa, L.** Deshi-badam, Bangla-badam, *Vern.*; Almond Tree.

A very large and handsome tree with wide-spreading crown and buttressed trunk. Bark cracked like that of *T. tomentosa* but less deeply furrowed. Leaves clustered towards the ends of the branchlets 6-10", obovate with a narrowly cordate base. Spikes solitary axillary. Fruit ellipsoid slightly compressed with a very thick hard and fibrous endocarp 1.7" long, within which is a small almond hardly worth the trouble of extraction.

Very commonly planted but only thrives in the more humid districts. Fl. March-May with the new leaves which turn a beautiful crimson colour in Jan. and Feb. and then drop.

2. **T. belerica, Roxb.** Lupung, K.; Lopong, S.; Behra, Bahera, H.; Bohera, Beng.; The Beleric Myrabolan.

A large tree with straight and tall trunk, broadly elliptic and obovate leaves 3-8" long clustered at the ends of the branchlets (alt. and distant on some growing twigs), petioles 1-2.5" long, and greenish-white or -yellow flowers .2-.25" diam. in solitary axillary or extra-axillary spikes 3-6" long. Fruit .75" diam. grey-tomentose, sub-globose or pyriform showing only faint furrows when dry.

Throughout the whole area, chiefly in mixed forest in the north, general in Sal forest in the Central Area, nearly always in valleys. Fl. March-May. Fr. Jan.-Feb. Deciduous Feb.-March, the new foliage being often copper-coloured.

Bark dark grey, blaze yellow. Leaves with rounded or obtusely-cuspidate apex and cuneate base, only very young with a little pubescence, usually dotted above, sec. n. 6-9 rather irregular, very minutely reticulate between on lower surface. Inflorescence pubescent, sometimes from axils of caducous bracts below leaves. Calyx-tube cupular, densely villous inside, sepals small triangular.

The fruits are used in tanning but have now but little market value. The kernels are eaten but are said to produce vertigo if many are taken. They are largely eaten however by monkeys, and many animals eat the fruits. The tree yields a gum which is eaten by the Santals. As a constituent of "*triphalā*" or the three myrabolans, they are used in very numerous diseases by Hindu physicians, especially in hoarseness and cough. There is no distinct heartwood and the timber is little used except for temporary huts. The growth is fairly quick. Two trees sown by me attained 21.9" girth in 16 years and a height of 36 ft. *Gamble* says that it is moderate to rapid, 3 to 7 rings per inch of radius, and that the wood is used in some parts for house-building after steeping in water.

3. **T. chebula, Retz.** Rola, K., S.; Hadra, *Uran*; Hara, Hara-taki (the fruit), Beng.; Kasa-phal (Mayurbanj); Harida, Or.; The Chebulic Myrabolan.

A small or m.s. tree with a rounded crown, usually sub-opposite ovate or elliptic leaves 4-7.5" by 2-4" and whitish flowers in spikes from the upper new leaf axils and forming small terminal panicles. Drupe ellipsoid 1-1.25" long glabrous, 5-ribbed when dry due to the 5-ribbed endocarp.

Throughout the whole province, especially common on the low hills and plateaux and ascending to the highest points. It appears to favour clay soils. Fl. April-May with the new leaves. Fr. Nov.-Feb. Decid. Feb.-March.

Trunk usually short and crooked, bark grey or dark-grey, in old trees cracked and flaking, blaze thick hard, deep grey-brown on the outside then yellow or sometimes an intermediate reddish zone. Young shoots and leaves usually beautifully silvery-silky, adult nearly or quite glabrous, acute or obtuse with a rounded rarely acute base and 7-9 prominent oblique slightly arched sec. n., nervules very finely reticulate as in other species. Petiole .5-1" with usually 2 glands near the top. Spikes 2-3.5", pubescent or tomentose. Bracts linear as long as the buds, caducous.

Fls. very densely white-villous within. Stone 5-angled, very thick with gum vessels in the walls and convolute cotyledons.

There are several varieties or forms, chiefly dependent on the amount of pubescence. In one the hypanthium is densely villous, in another glabrous; the villous one is far the commoner. In Mayurbhanj a form occurs with the leaves nearly glabrous from the first, while on Parasnath a form occurs with the leaves shaggy beneath and the drupes only '75" long.

It is the best of the Myrabolans for tanning, and the best quality is considered to be those "nuts" (so called in the trade) with a bright orange colour (this has, however, been denied); they are best collected off the ground as soon as they fall.

The tree is a great light demander, at least for good fruit-bearing, though the seed germinates best in shade. It is frost-hardy and coppices well. The growth is rather slow, but '7" girth increment p.a. has been recorded in Singbhum. The fruit is largely eaten by animals, especially Chital. *Hari-taki* is the chief Myrabolan in Hindu medicine and is highly prized as an alterative and tonic.

4. *T. arjuna*, W. & A. Kowa, Gara Hatana, K.; Kahua, S.; Kahua, Kharw.; Arjun, H.

A large tree with pale greenish or grey bark, long inclined branches with opp. or sub-opp. oblong leaves 2-3-times as long as broad, but smaller ones at bases of shoots elliptic, sub-sessile, soon glabrous. Flowers .2" diam., white, in shortly paniced spikes. Fruit 1-1.5" long, wings less than .5" wide, usually premorse above, with ascending striations.

Common along nalas where it sometimes attains an immense size in the Central and Southern areas. Not noted from the Northern area and not very common in the Santal P., also rare or absent in Puri, Balasore and Cuttack. It thus chiefly occupies the valleys of the dryer hilly districts. Fl. May-July. Fr. March-April. Evergreen or nearly so, renewing its leaves at the time of flowering.

Attains 12 ft. girth and 100 ft. in height with smooth bark or slightly flaking on old trees and deep red or crimson blaze distinctly zoned. Leaves with 2 glands near the base or on the very short petiole which is under .5", margin entire or crenate but nerves not excurrent as teeth.

Seedlings have often toothed and usually linear-lanceolate glabrous leaves and there are often 3 cotyledons which are very broadly cuneate, '7-1.8" diam. at apex, with slender .5-7" long petioles. Two trees which were sown by me attained in 16 years an average height of 38.5 ft. and girth 34.2". The timber a good deal resembles that of *T. tomentosa* and is used for building and agricultural implements, but the chief use of the tree latterly has been for the bark, which is good for tanning and can be removed, i. e. the outer bark, which is the best, without damaging the tree.

Gamble gives the weight of the wood as 52-69 lbs.

The bark is also used in native practice as a tonic and astringent and is said to be useful in heart diseases, contusions and ulcers.

5. *T. tomentosa*, W. & A. Hatana, atana, K., S.; Asana, Th.; Saj, Asan, Sain, H.

A large tree with dark cinereous rough bark, deeply cracked into oblong segments, opp. or sub-opp. elliptic or ell.-ovate or, in some varieties, oblong leaves 5-9" long, entire or nerves excurrent as teeth, subsessile or petioled with distinct tertiary nerves, under-surface permanently pubescent or with a close felted tomentum or in one variety glabrescent. Two large glands beneath or on the petiole. Flowers and panicles much as in *T. arjuna* but panicles often larger. Fruit 1.5-2" long or sometimes attaining 3" by 2.5", wings over .5" broad with horizontal striations.

Throughout the whole area and perhaps the commonest tree. It is partial to the more humid valleys and only there attains its best development, but appears as a

TERMINALIA.]

62. COMBRETACEÆ.

small tree on the hills and plateaux. Fls. May-June. Fr. Feb.-March. Decid. March-May.

As might be expected in so widely distributed and common a tree, there are several forms or varieties:

Var. *a nepalensis*. Ujar-ki-Asan, Th. Leaves large, usually oblong, 8-11" long, with a very close short tomentum beneath whence the under-surface appears white or grey. Sec. n. over 20 with oblique scalariform tertiaries. Inflorescence tomentose or closely shortly pubescent, bracts linear-subulate. Fls. 16-17" diam. Hypanthium tomentose slightly longer than broad, calyx outside thinly pubescent or almost glabrous at tips, sepals triangular mucronulate, inside with long villi and large lobed disc densely villous-hirsute.

Lower hills and valleys of the Northern Area, entering Nepal. The sawyers say that the wood is lighter coloured and superior to that of the ordinary Saj. Whether this is the same tree as var. *coriacea*, Clarke, of the Coromandel Coast I am unable to say without further specimens.

Var. *β typica*, Clarke. The Central India Saj. Leaves usually more or less elliptic-oblong or ovate, often serrate esp. when young, hairy beneath esp. on the nerves. Sec. n. usually fewer than 20. Inflorescence with a looser longer indumentum but flowers 18-19" diam. with the sepals inside far more shortly villous, deltoid; hypanthium broader than long, densely pubescent; calyx outside pubescent or hairy. Disc much as in last.

The Common Saj or Hatana of Chota Nagpur and the Central Provinces. The fruit is often very large and always glabrous.

There are other forms, including one which is very nearly glabrous in the Santal Parganas, and there are also what appear to be hybrids between this species and *T. arjuna*. The seedlings of *T. tomentosa* are usually toothed and hairy.

The tree is very easily grown from seed and appears to prefer a clayey loam. It is more patient of water-logging than most trees. In coppicing it throws out far too many shoots from the top of the stump which are apt to remain weak unless thinned out. In unfavourable localities seedlings may apparently take some twenty years to form a stem and this is frequently a sympodium. Seed sown by me in Singbhum grew on an average 30 ft. in height and 20 3/4" girth in 16 years and were thus much slower than the *Arjun*.

The timber of *T. tomentosa* is very useful and has been largely cut for sleepers (which are, however, far inferior to Sal), as well as being one of the principal trees used as poles in native houses. It is also an excellent fuel. Gamble gives the weight as about 52 to 70 lbs. It is the tree pollarded throughout Chota Nagpur for feeding the Tusser Silk-worm. The bark appears inferior for tanning to the last. The young ovaries are attacked by a cynips, so that panicles of galls are very common on the tree, which are sometimes mistaken for fruits.

2. ANOGEISSUS, Wall.

Trees or shrubs with opp. or sub-opp. and alternate entire usually dotted petioled leaves and small greenish flowers in globose axillary peduncled heads. Ovary inferior and hypanthium produced above it into a beak and then into a campanulate 5-lobed "calyx-tube." Petals 0. St. 10 in two series adnate to the campanulate tube outside the crenate hairy disc. Ovules 2 pendulous. Fr. small indehiscent compressed, 2-winged, beaked, in densely packed heads. Germination epigeal but hypocotyl very short, cotyledons transversely oblong sub-reniform, petioled, convolute in the seed.

Bark smooth pale. Leaves broadly elliptic, obtuse both ends . . . 1. *latifolia*.
Bark dark. Leaves elliptic acute, one or both ends . . . 2. *acuminata*.

A. latifolia, Wall. Hesel, K., S.; Dhaunta, Kharw.; Dhaura, H.; Bhanji, Th.

A straight large or m.s. tree with whitish bark and alt. to opposite usually broadly elliptic leaves 2-4" long rounded or obtuse at both ends, in most cases glabrous with age. Peduncles usually shortly racemed or 2-3-nate. Fruit (excluding beak) about as long as broad rarely 25", beak equalling or shorter than the diam. of the fruit, at length deciduous.

In the Northern Area chiefly on dry ridges in the west, absent from the eastern districts. In the Central Area very common, forming a large proportion of the growing stock on the dryer hills and also frequent in second growth, also common in the Southern Area except on the coast. Fl. June-Sept. Fr. Dec.-Jan., rarely up to the end of March. Deciduous Feb.-April. Leaves turn red or brown in December.

Bark smooth, shed in thin roundish flakes, blaze first a chlorophyll layer, then brown-pink, inside (on wood) pale brown. Leaves sometimes sub-orbicular or emarginate, rarely acute, with 8-14 distinct sec. n. curved before reaching the margin, pellucid dots visible with a lens from above but often not from beneath. Petiole 25-75". Heads (without st.) 3" diam. Wings of fruit entire or angled but not jagged.

Var. tomentosa, Haines (F.C.N.). Twigs and leaves, especially beneath, persistently tomentose (but not smaller as in *Clarke's* variety *villosa*). Fruits slightly puberulous above, only about as broad as long and beak as long.

Manbhum, Palaman, and west of Hazaribagh!

The tree is a very useful one and is especially in request by the agriculturist for posts, implements and carts. Axles are manufactured out of large trees as well as from poles. In the Monghyr market it commands the best price of all woods as fuel. It is very strong, tough and elastic, but the values given for P in *Gamble's Manual* vary from 752 to 1220. *Troup* includes it only in his fourth class in which P = 700-800. Weight 56-68 lbs. (*Gamble*).

The twig, bark and leaves have assumed considerable importance during the war for tanning purposes. According to *Mr. Fraymouth* the September shoots are better than those produced in other months. A scheme for pollarding has been proposed to yield several flushes of shoots and leaves in the year. Several notes on reproduction are given in *Mr. Tireman's* paper before the Tannin Conference. I have germinated seed fairly easily on heaps of rubble, and in the forest natural clearances caused by land-slips and with some lateral shade are often thickly covered with seedlings. The cotyledons are 5-6" diam. with petioles 2-4" and the young seedlings are very hairy. Trees raised in Chaibassa from seed had an average height of 30 ft. 10" and girth 18-9". *Gamble* gives 7 rings per inch of radius for the growth and more details are given in the paper cited. The young trees coppice fairly well in the hot season. *Mr. Makins* has recorded 5-year-old coppice 16 ft. high and 9" girth. It is fairly frost-hardy.

2. A. acuminata, Wall. Gara-hesel, Parsia, K.; Chakwa, Beng.; Phansi, Or.

A large and beautiful tree with slender drooping branches but often flowering as a small tree. Leaves 75-225" long, mostly sub-opposite, narrowly elliptic or elliptic or elliptic-oblong, acute one or both ends and apiculate; base nearly always cuneate, beneath densely sericeous when young more or less glabrescent with age and old leaves glabrous above, sec. n. 5-8 or up to 12 on the longer leaves, fine and distinct. Peduncles mostly solitary from the leaf scars and axils. Hypanthium above and beak densely pubescent, calyx-tube glabrous without. Fruit 13-18" long and 24-28" broad with upper part

pubescent and beak much shorter than diameter, wings often lobed or irregularly cut and angled or toothed.

Central and Southern areas, along rivers and streams. Singbhum, not uncommon and attaining 8 ft. girth in Saranda! Athmallik! Mayurbhanj! Puri! to Sambalpur! Frequent along the Mahanadi. Fl. March-April. Fr. April-May. Evergreen or nearly so, renewing its leaves at the time of flowering or fruiting at which time the old ones are also shed.

Attains 8 ft. girth with nearly black cracked bark and red blaze. Young parts densely sericeous or tomentose. Leaves often rounded at the tip but apiculate and with cuneate base, rarely base obtuse and only in some leaves, dots appearing translucent and due to crystal-cells are numerous. Peduncles usually solitary but in one form clustered and branched; they sometimes appear paniced by arising on leafless twigs.

The wood is used for cart axles and ploughs and some natives state that it is superior to that of *A. latifolia*. Gamble states that it is inferior to that tree and that it warps and cracks in seasoning; he gives the weight as about 50 lbs.

3. CALYOPTERIS, Lamk.

A shrub with opp. entire leaves with minute scales beneath and greenish flowers in dense axillary and paniced spikes or racemes. Flowers with a tendency to zygomorphy, the style being always declinate towards the posterior sepal. Hypanthium 5-angled expanded above the ovary into a campanulate "calyx-tube" without a disc, villous both inside and out with 5 large sepals and 10 stamens in two series. Petals 0. Ovules 3-5 on long funicles. Fruit crowned by the greatly enlarged wing-like sepals. Cotyledons convolute.

1. *C. floribunda*, Lamk. Sil, Or. (also Achindi and Atundi, through confusion with Combretum); Kukaranji, Gondi.

A large sarmentose or climbing shrub attaining 18" girth with rusty villous shoots, opposite ovate or elliptic acuminate leaves 2.5-5" long copiously covered with minute peltate scales beneath, densely tomentose when young and pubescent rarely quite glabrescent when old. Flowers villous in dense bracteate spikes or sometimes with short pedicels, .26" long in flower with sepals .15-.17" long, spikes in large terminal panicles. Calyx rapidly enlarges after flowering with membranous sepals .5-1" long crowning the 5-ribbed indehiscent 1-celled fruit which is villous and .3" long.

In the Southern tract only. Mals of Puri! Angul, common! Narsingpur, common! Fls. March-April. Fr. May.

Leaves with rounded base and about 9 sec. n. curved up within the margin and with not very strong scalariform tertiaries, usually permanently pubescent on the nerves beneath. Petiole .1-2."

It is curious that no work which I have seen makes mention of the very characteristic scales, which resemble those of a *Combretum*.

4. LUMNITZERA, Willd.

Large shrubs or small trees growing in salt marshes, with alternate coriaceous subsessile entire or crenate obovate leaves and narrow flowers in spikes or racemes with small bracts, and two bracteoles adnate to the hypanthium. Hypanthium narrow tubular, solid for some distance above the ovary and then produced as a funnel-shaped calyx-tube with small sepals. Petals 5 inserted in the throat of the calyx-tube. Stamens 10, or the anti-petalous ones failing. Ovary

1-celled with simple style sometimes adnate to one side of the calyx-tube. Ovules 2-5 pendulous. Fruit woody, crowned by the calyx-tube. Radicle long, only partly enfolded by the convolute cotyledons.

1. *L. racemosa*, Willd. Tunda, Or.

A small tree with rough bark and small obovate or oblanceolate entire or crenate fleshy leaves 1.5-2" long. Flowers small white .25" diam. in mostly axillary spikes.

Tidal forests of the Mahanadi delta! Fl. April-May. Fr. May-June.

Leaves with a long cuneate base and rounded or emarginate apex, venation obscure. Hypanthium and calyx together .3" long, lobes small rounded minutely ciliate. Petals entire .12" ell.-obovate. Fruit .5" (in May and not quite ripe) bottle-shaped, clasped at the base by the two oblong-spathulate bracteoles, striate.

5. COMBRETUM, L.

Usually large sarmentose shrubs (*C. nanum* is a dwarf shrub) with opp. or sub-opp., more rarely alternate, entire leaves, often with small peltate scales beneath. Flowers small white or greenish in our species (showy in some exotics) in spikes or racemes which are usually paniced, sometimes with large white petaloid bracts, polygamous. Hypanthium constricted above the ovary, expanding into a tubular or urceolate "calyx-tube", above it, and sometimes with an intermediate very narrow tube or beak, sepals small 4-5, petals as many or 0, stamens twice as many, 2-seriate. Disc usually lining the calyx-tube with villous margins within the stamens. Ovary with 2-5 pendulous ovules. Fruit with 4-5 angles or wings, dry. Seed one, with flat or plicate rarely convolute cotyledons.

A. Flowers 5-merous. Fruit 5-winged 1. *decandrum*.

B. Fls. 4-merous. Frt. 4-winged.

Large sarmentose shrub or climbing shrub 2. *ovalifolium*.

Undershrub. 3. *nanum*.

NOTE.—*C. extensum*, Roxb., is quoted in *Bengal Plants* from Chota Nagpur. The supposed specimen, collected by Dr. Wood, is in the Calcutta Herbarium and is merely *Terminalia chebula*.

1. *C. decandrum*, Roxb. Phalandu, K.; Aten, S.; Rateng, Kharw.; Atundi, Kala-Achindi, Or.

A large bush or scrambling climber or twining from left to right, sometimes covering the highest trees and conspicuous from the large white bracts on the inflorescence. Leaves coriaceous oblong shortly suddenly acuminate 3-5" long rarely 7" by 3", shining above, glabrous or somewhat appressed hairy or with tufts of hairs in the axils of the strong sec. n. beneath. Spikes rusty villous .5-1" rarely 2" long in large axillary and terminal panicles. Fls. 5-merous with urceolate calyx-tube .17" diam. densely villous-pubescent. Frt. oblong or elliptic 1-1.25" long.

Very common throughout the province, especially along nalas but also forming dense low masses in scrub jungle, as in Gaya. Fls. Nov.—Feb. Fr. April-June. The leaves on the panicle turn white or cream-coloured in November while the flower buds are unopened. Evergreen.

Sometimes forming a dense bush in the open with brown bark. Innovations densely rusty-villous. Leaves sometimes somewhat obovate-oblong, sec. n. 6-8, tertiary subscalariform, those on the panicle similar except as to colour and texture, bracts on the spikes becoming linear upwards, villous. Sepals sub-aristate, acuminate, petals ovate acuminate hairy, not much longer.

2. *C. ovalifolium*, Roxb. Atundi, Or.

A large climbing shrub with elliptic or oval, not at all oblong, leaves 2.5-4.5" long, apex rounded or with a very short obtuse cusp. Spikes 5-1.5" rarely 2", often racemose on a common rhachis and frequently by the fall of the leaves appearing copiously paniced. There are no white foliaceous bracts on the panicle. Fruit 4-winged only, often a beautiful claret colour when ripe, .75-.9" by .6-.7", shining, with numerous close horizontal striae.

Chota Nagpur, rare (Palaman, Rajkot)! Puri, fairly frequent! Angul! Palamau! Fls. Feb.-April as the leaves are dropping. Fr. May. Deciduous for a short time, renewing leaves in May, often a beautiful dark red before falling.

Very young leaves have a dense villous tomentum near mid-rib and lower sec. n., mature with a rounded or shortly cuneate sometimes unequal base, sec. n. 6-8. The under surface of the leaves shows under a lens numerous minute discs evidently corresponding to the scales so evident in some species but in this case scarcely differentiated from the rest of the leaf surface. Petiole .4-.7". Fls. usually dense towards the end three-fourths of short lateral branches of panicles 2-2.5" long which arise in the axils of falling or fallen leaves, and are pubescent. Petals rather shorter than the 4 triangular acute sepals and narrowly obovate with sometimes retuse apex. Disc densely hairy. There are two forms:

α. Hypanthium below the calyx-tube .14" long and pubescent.

β. Hypanthium below the calyx-tube .09-.1" long glabrous and varnished.

In both forms it is slightly narrowed upwards and 4-angled.

Var. *Cooperi*, Haines.

This is a remarkable plant but too fragmentary to describe. The leaves are exactly those of *C. decandrum* except that it has the scales characteristic of but more pronounced than in *C. ovalifolium* and one of the lower leaves has also the shape of the latter species. The plant is in fruit with pubescent axillary panicles 3-4.5" long. Fruits all 4-winged but oblong 1.8-1.9" long by .75-.8" with red colour and texture of *C. ovalifolium* and minute scales between the wings as in that species.

The plant is described as a climber and might very well pass as a hybrid between *C. decandrum* and *C. ovalifolium*. Kalahandi, *Cooper*!

3. *C. nanum*, Ham. Phirtol-rel, Andaika, K.

An undershrub with woody rootstock, and numerous erect stems or branches 1-2 ft. high, opp. or alternate leaves which are orbicular or obovate or lanceolate 2-4" long and are at first bright red and again turn brilliant red in December and January. Petiole .5". Flowers white in rather dense racemes 4-8" long. Hypanthium obconic. Petals far exceeding the sepals. Fruit 1-1.5", a pretty pink or crimson, 4-winged.

Burnt jungles and fire-lines more especially on the plateaux. Throughout Chota Nagpur! Gaya (on the ghats and hills)! Fl. with the new shoots March-May. Fr. April-Aug. Deciduous Jan.-Feb. and in unprotected forest usually burnt down by the jungle fires.

6. *QUISQUALIS*, L.

Quisqualis is chiefly distinguishable from *Combretum* by the hypanthium produced into a very much longer slender tube above the ovary and the style partly adnate to the tube, funicles long with their papillose inner sides almost connate. Flowers showy.

1. *Q. indica*, L.

A large handsome climber with elliptic-oblong shortly acuminate leaves 3-4" long, petiole '3-4" at first, persistent and often transformed into recurved spines after the fall of the leaf and by which the plant is assisted in climbing. Flowers showy in terminal racemes with bracts '3-4"', hypanthium about 3" long, petals '8-1" at first white then changing to red and crimson. The flowers are beautifully scented of an evening.

Very common in gardens. Indigenous in the Malay Peninsula, Philippines and western tropical Africa.

The genus *Gyrocarpus* is transferred to Hernandiaceæ.

FAM. 63. MYRTACEÆ.

Trees or shrubs with opposite, very rarely alternate, exstipulate, simple entire, usually evergreen and shortly petioled leaves which with the young stems and parts of the flower and fruit are usually copiously supplied with lysigenous oil glands. Flowers 2-sexual regular perigynous or epigynous, the hypanthium adnate with the ovary and often produced into a tube (calyx-tube) above it. Sepals 4-5 imbricate usually persistent. Petals rarely 0, inserted on, or on the margin of the epigynous disc, or disc lining the hypanthium. Stamens usually numerous and many-seriate inserted with the petals, filaments free or variously connate, anthers small with longitudinal dehiscence, usually dorsifixed. Ovary syncarpous 2-many-celled with axile placentation, rarely 1-celled and placentation basal. Ovules usually numerous anatropous or campylotropous, sometimes only 2 or 1. Fruit various, baccate, drupaceous or opening by as many valves as there are cells. Seeds usually 1-few, exalbuminous, embryo straight or curved.

Germination usually hypogeal.

The venation of the Myrtaceæ is like that of the Combretaceæ or more usually the sec. n. loop continuously within the margin or join an even intramarginal nerve.

The Lecythidaceæ (including *Careya* and *Barringtonia*) are included in the F.B.I. and many other works in this family.

I. Fruit baccate.

A. Cotyledons thick and fleshy. Sep. 4. Seeds 1-few . . . 1. *Eugenia*.

B. Embryo horse-shoe shaped. Cotyledons small with comparatively large hypocotyl.

Fls. axillary solitary. Sepals free in bud . . . 2. *Myrtus*.

Flowers paniculate cymose . . . 3. *Pimenta*.

Peduncles axillary 1-3-fld. Calyx entire in bud irregularly splitting in flower . . . 4. *Psidium*.

II. Fruit dry, loculicidally splitting at top.

Fls. capitate or umbelled. Petals calyptrate . . . 5. *Eucalyptus*.

Fls. in axillary spikes. Petals 5 spreading. St. in bundles opposite the petals . . . 6. *Metalenca*.

Fls. in proliferous spikes. Stamens free . . . 7. *Callistemon*.

1. EUGENIA, L.

Trees or shrubs with often quadrangular branches and usually opposite glabrous gland-dotted leaves. Flowers sometimes solitary axillary but usually in 3-chotomous cymes. Hypanthium often produced into a calyx-tube above the ovary which is truncate or with 4-5 sepals. Petals 4 rarely 5, sometimes calyptrate. Stamens with

small versatile anthers often with a gland at the tip. Ovary 2-rarely 3-celled, style simple. Ovules many in each cell but only 1-few developing. Embryo thick with short axis and large fleshy cotyledons. Germination hypogeal.

I. Flowers cymose. Hypanthium produced beyond the ovary as a calyx-tube.

A. Stamens not inserted on a thickened disc. Petals usually calyptrate (*Syzygium*).

1. Secondary nerves and intermediate very fine close and numerous.

a. Branches of panicle rounded in section.

L. oblong or ell.-oblong over 4" not glaucous, glands conspicuous. Berry oblong or ellipsoid

1. *jambolana*.

L. ell. or lanceolate mostly under 4", glands obscure. Berry pisiform

2. *caryophyllifolia*.

L. narrowly oblong or lanceolate. Berry dry oblong or ovoid. Often shrubby, glands very conspicuous

3. *Heyneana*.

b. Branches of panicle square in section.

Branches of panicle sharply 4-angled. L. of *Jambolana* not glaucous, glands more evident, surface often shining

4. *fruticosa*.

Branches of panicle obtusely 4-angled. L. broadly ell. to ell.-oblong 2.5-5" dull and very glaucous

5. *glaucissima*.

2. Sec. n. 8-15 distinct and raised beneath

6. *operculata*.

B. Stamens inserted on a thickened disc. Petals not usually calyptrate. Flowers often large (*Jambosa*).

1. Angles of twigs decurrent into a sac above the nodes. Large indigenous tree. Petals sometimes calyptrate

7. *lanceafolia*.

2. Angles of twigs not saccate at the extremities. Small cultivated trees.

Flowers 2-3" diam. Fruit globose

8. *jambos*.

Fls. 1.5" diam. Fruit shining turbinate

9. *javanica*.

II. Flowers solitary or sub-racemose. Hypanthium not produced into a tube above the ovary (*Eugenia* proper).

Shrub

10. *bracteata*.

1. *E. jambolana*, Lamk. Jamun, Jam, H.; Kala Jamb, Beng.; Jamkuli, Or.; Kuda, K.; So-kod, S.; Jambun, Ur.

A large tree everywhere glabrous with oblong or elliptic-oblong acute or acuminate shining leaves mostly 4" or more long, with very numerous close spreading sec. n. and intermediate nearly as strong. Fls. white sessile mostly in threes in 3-chotomous panicles with terete branches. Hypanthium turbinate 1-2" long, sepals 0 rarely small. Petals calyptrate. Berry ellipsoid or oblong, often curved.

Very common throughout the area, wild or cultivated. The wild tree occurs chiefly along rivers and nalas. Fl. May-June. Fr. June-July. Evergreen and renews leaves about the time of flowering though the inflorescence usually appears on the previous years' twigs.

Attains 8 ft. girth or more in sheltered ravines, with grey-brown or nearly black often pitted bark more or less cracked when old. The trunk is nearly always single. Blaze thick, deep red or brown. Wood reddish-brown to reddish-grey.

Seed nearly always solitary with thick rounded fleshy cotyledons closely appressed on their inner faces. Seedling stems sharply 4-angled with linear or lanceolate leaves 4-1.5" long in their first year, alternate or opposite, without the close fine nervation of the adult.

Timber good and has latterly been much used for sleepers. It is also used for building and for well-curbs, agricultural implements and carts. It is a very good heating fuel. Weight 40-50 lbs. The fruit is eaten and a preparation is given as a stomachic, as a remedy in enlarged spleen and in chronic diarrhoea. The bark is also used for diarrhoea and dysentery and the seed in diabetes. It is a very good avenue tree except in very dry situations.

The following species, nos. 2-5, should in my opinion be all treated as varieties of *E. jambolana* or all treated alike as species. It is usual to treat *E. fruticosa* and *E. Heyneana* only as species. The two hill trees *E. caryophyllifolia* and *E. glaucescens* can be distinguished in the forest without any difficulty whatever, whereas it is sometimes very difficult to discriminate between *E. fruticosa* and *E. jambolana* without inflorescence. In the herbarium they are always recognised by the inflorescence.

2. *E. caryophyllifolia*, Lamk. Syn. *E. jambolana* var. *caryophyllifolia*, F.B.I.; Buru-kuda, K.; Bir-kod, S.

A small or m.s. tree with pale branchlets, ell. or lanceolate or ovate lanceolate acuminate leaves mostly under 4" long, the glands very small and inconspicuous. Fls. white sessile but often sub-pedicelled with much contracted base, usually clustered at the ends of the branches of short 3-chotomous or irregularly branched panicles with terete branches. Bracts among the flowers caducous linear-subulate. Hypanthium turbinate 1-15". Sepals small rounded. Petals calyptrate. Berry pisiform.

Hills of Chota Nagpur, very common. Fl. May. Fr. June. Nearly leafless at the time of flowering; the young leaves then all come out together generally of a brilliant red colour.

3. *E. Heyneana*, Wall. Gara-kuda, K.; Chuduk' Kod, S.; Kat-jaman, Kharu.

A shrub or small bushy tree 8-20 ft. high with narrowly oblong-elliptic or lanceolate acuminate leaves 3-5" by 1-1" and lateral cymes of capitate white flowers from the old twigs. Berry 5" oblong crowned by the calyx-tube.

Along streams. Champaran! Common in Chota Nagpur! Frequent in the Southern Area and probably in all districts except perhaps on the coast. Fl. May-June. Fr. July-Aug.

Leaves have glands more evident than in *E. jambolana* and the cymes are usually longer-peduncled, 2-3" long with brachiate branches. Fls. sub-sessile usually several in a head, sepals small.

A form collected by me on the Mahanadi in Angul has linear-lanceolate leaves only 1-2" long. The presence of the calyx-tube on the fruit is not a specific distinction; it occurs even in the cultivated forms of *Jambolana*.

The fruit is sometimes said to be eaten.

4. *E. fruticosa*, Roxb. Bhalu Jamun, Or.

A large tree* but usually branched low or from the base with leaves closely resembling those of *E. jambolana* often long acuminate very distinctly glandular, shining or not. Fls. as in *jambolana* in short panicles but with sharply 4-angled branches. Bracts among the flowers minute very caducous. Hypanthium turbinate or broadly campanulate. Sepals 0. Petals calyptrate or sometimes expanding. Fruits globose 25-3" diam.

Mountains of Mayurbhanj 2500-3500 ft. Fl. May-June. Fr. July. Ev. Renews leaves from February onwards.

Bark pale grey, in young trees with chlorophyll, dark grey or with pale patches and somewhat cracked in old trees. Blaze brown as in *Jambolana*, L. usually narrow ell. and acuminate with dots conspicuous beneath when dry, 3-55".

* It is described as a shrub by Roxburgh, but all the specimens in the Calcutta Botanic Garden have grown into trees. There are several other cases of Chittagong plants being found in Orissa (see Introduction).

Petioles '5-9", divaricate. Fls. usually very small, '1" only, but in Mayurbhanj specimens '15 by '2" with raised glands inside and out. St. '2" long. Fruits (in Maymyo specimens) globose '3-35" diam.

5. *E. glaucissima*, Haines.

A small tree with broadly elliptic to ell. oblong long-acuminate leaves 2.5-5", rarely attaining 7" and oblong lanceolate, very glaucous and not shining, with very conspicuous pellucid dots. Fls. white sessile ternate or clustered at the ends of the short branches of rather irregular panicles with 4 sided but not sharply 4-angled branches. Bracts among the flowers caducous minute obtuse or acute oblong or triangular. Hypanthium obconic then saucer-shaped '15" long and broad. Sepals 0. Pet. calyptrate. Berry sub-globose (excluding the short truncate tube) or broadly ellipsoid, glands in the pericarp large and numerous.

Hills of Chota Nagpur 2000-3000 ft. ! Fl. May. Fr. June. Evergreen. Bark pale. Blaze rather hard, light red in young, deep red in old trees. Petiole '5-7". Cymes from previous years' leafless axils stout, '5-15" with few branches. Regarded as a variety it is not clear whether this is most nearly allied to *E. jambolana* or to *E. fruticosa*.

6. *E. operculata*, Roxb. Topa, K.; Totonopak', S.; Paiman, H.; Bodara, Th.; Satiam, Bawal, Or.; Pui Jamla, Gond.; Dumkol (Gaya).

A low tree with broadly elliptic or obovate and rounded leaves 5-7.5", more rarely oblong-oblancoate or ovate and acuminate, sec. n. rather irregular 7-12. Fls. white sessile ternate in brachiate panicles 3-6" long mostly from old leaf scars. Berry glabrous '25-3" (-5", F.B.I.).

Widely distributed in the damper forests but not common except in the north. All along the northern boundary esp. in Purneah in open grassy jungle tracts! Valleys in Singbhum, Hazaribagh, Manbhum and Santal P., especially in grassy glades! Ranchi ghats, near streams! and the cool tops of the highest mountains, e.g. Parasnath and Meghasani! Gaya, at foot of ghats! Angul! Sambalpur! Fls. April-May. Fr. June-July. The leaves turn red before falling.

Bark rather rough, blaze red. Twigs 4-angular. Leaves usually 2.5-3.5" wide or, in one form occurring in Chota Nagpur, 1.75-2" wide only, dots small. Petiole '5-7.5". Hypanthium obconic '15-18" long and broad. Sepals 4, transversely oblong, glandular. A large gland also on connective.

The fruit is eaten for rheumatism and an extract of the root boiled down to the consistency of gur is rubbed on the joints for the same disease while the leaves are used in dry fomentations. The tree is seldom straight and the wood usually used only for agricultural implements. Weight 45-50 lbs.

7. *E. lanceafolia*, Roxb. Syn. *E. Wallichii*, var. *lanceafolia*, F.B.I.

A large tree with smooth nearly white bark, twigs 4-angular above the nodes with distichous oblong or lanceolate acuminate glabrous leaves 3-7" long, shining above, and white flowers in lateral corymbose cymes 1.5-2.5" long and broad. Berries narrow oblong crowned with the calyx. The most characteristic feature of the species, however, is the way in which the two pairs of internodal ridges unite and form two prominent sacs above or at each node.

Mayurbhanj, Simlipahar Range, elev. 3000 ft. in dark valleys! Fl. Nov.-Jan. Fr. Feb. Evergreen.

Large trees are much buttressed below, blaze hard with chlorophyll, then dark red. Leaves translucent-dotted seen from beneath and with minute yellow glands, acumen often very slender, base rounded, obtuse or acute, sec. n. about 12 scarcely stronger than intermediate, others fine and reticulate. Petiole '3-5". Cymes corymbose, axillary, 1'5-2'5" Hypanthium '2", turbinate, sepals broad, semi-orbicular. Petals usually calyptrate. St. '4-5" long. Berry '4" oblong, contracted into a neck below the persistent calyx.

The distribution of this fine tree outside our area is from the Duars to Assam and Chittagong. Roxburgh says of it, "I am inclined to consider this one of the most elegant and most useful species of this genus."

8. *E. jambos*, L. Syn. *Jambosa vulgaris*, DC.; Gulab-jamun, H.; The Rose-apple.

A small tree with lanceolate leaves 5-8" long narrowed into a short petiole, sec. n. rather distant joined by a prominent looping intra-marginal one. Easily recognised by its very large handsome flowers about 3-4" diam. (with the long stamens) and which are in short terminal racemose cymes with pairs of flowers (trichotomous cymes with the central axis not at once terminating in a flower). Sepals rounded. Fruit globose white 1-2" with 1-2 grey seeds loose in the large cavity of the succulent pericarp.

Very commonly cultivated and semi-wild in the village jungles of Purneah, also cultivated in Santal Parganas, Balasore, etc., but does not succeed well in the dryer districts. Fl. March-April and fruits in the r.s.

The fruit has a sweetish rose-water flavour and is very indifferent eating.

9. *E. javanica*, Lamk. Syn. *E. alba*, Roxb.; Jamrul, Beng.

A small tree with oblong acuminate sub-sessile or very shortly petioled leaves 5-10" long with a narrowly cordate or sub-cordate base and conspicuous nervation. Flowers not nearly so handsome as in the last, about 1'5" diam. or 2'2" with the stamens, in lateral and terminal short cymes and often from the old branches and trunk. Staminal receptacle somewhat pulvinate with a yellow colour. Fruit turbinate almost flat above rather a pearly or pinkish white crowned by the fleshy inflexed sepals, very watery and flavourless.

Cultivated only in the southern moister districts, e.g. Cuttack. Fl. April. Fr. May. Native of Malacca.

10. *E. bracteata*, Roxb. *Sagarabatua*, Unchana, Or.

A pretty myrtle-like shrub 2-4 ft. high with leaves 1'5-3" very faintly nerved (until dried). Flowers 4-7" diam., white, usually solitary extra-axillary but often appearing terminal (being crowded on the new shoots with undeveloped leaves). Berries red or ultimately black globose 1-2-seeded about '3-4" diam. crowned by the 4-leaved calyx.

Very common on sandy ground in Orissa near the coast from Cuttack southwards and often in the laterite scrub jungle! Fl., Fr. all the year round.

Twigs brown. Innovations brown-hairy as well as the inflorescence. L. lanceolate, oblanceolate, elliptic or rhomboid usually contracted at the base, apex obtuse subacute or acuminate, copiously gland-dotted. Petiole '1-2" Pedicels '3" Calyx with a circular brownish pubescent disc. Sepals 4 oblong obtuse '1'5" long somewhat pubescent esp. on edges.

The ripe fruit is eaten.

2. MYRTUS, L.

Myrtus differs chiefly from *Eugenia* in the horseshoe-shaped embryo, small cotyledons and comparatively large hypocotyl. The petals expand. Carpels 2-3 forming a wholly or almost wholly (septa not quite reaching the apex of the ovary) 2-3-celled ovary, with axile placentation.

1. *M. communis*, L. The Common Myrtle.

A shrub with small ovate to lanceolate leaves 1-1.5" long, very sweet smelling, white flowers about .75" diam. solitary axillary on slender peduncles succeeded by ellipsoid berries which finally turn black and are crowned by the 4-5-partite calyx.

Often planted in gardens. Indigenous from the Mediterranean to North West Himalayas.

3. PIMENTA, Lindl. Allspice.

1. *P. officinalis*, Berg.

A small bushy evergreen tree 20-30 ft. high with aromatic narrow-oblong leaves with many sec. n. and terminal and axillary 3-chotomous paniculate cymes of rather small white flowers. Sepals and petals 4. Ovary 2-celled with 1-2 pendulous ovules in each cell. Fruit somewhat like a pepper-corn when dry, 2-seeded. Native of the West Indies; sometimes found in the gardens of Indians. The unripe berries dried in the sun yield the Oleum Pimentæ.

4. PSIDIUM, L. The Guava.

1. *P. guayava*, L. Syn. *P. pyrifera* and *P. pomifera*, Willd.; Amrud, H.; Piyar, Beng.

A large shrub or small tree with opposite entire ell.-oblong leaves 4-6", pubescent beneath and with 15-20 sec. n. Peduncles axillary with 1-3 pretty white flowers 1-1.5" diam. Ovary usually 4-5-celled with many ovules. The well-known fruit with many very hard seeds. Embryo horseshoe-shaped.

Almost or quite naturalised in the village jungles of Purneah! Native of tropical America. Fl. h.s. Fr. r.s. and c.s.

5. EUCALYPTUS, L'Heritier.

Trees, often gigantic in their native forests, sometimes flowering when quite small, secreting an aromatic gum or resin. Leaves coriaceous, at first often opposite sessile and horizontal (for 3-5 yrs. in *E. globulus*), in older trees they hang obliquely or vertically, are petioled and of a different shape, studded with oil glands and frequently glaucous. Flowers small in heads or umbels rarely solitary axillary. Hypanthium continuous with the pedicel and often usually produced beyond the ovary as a truncate "calyx-tube" without sepals. Petals entirely fused into a calyptra. Stamens numerous. Ovary 3-6-celled with numerous axile ovules. Fruit usually hard and woody dehiscent loculicidally at the top. Seeds numerous.

A very large Australian and Tasmanian genus, the species of which are variously known as Gum-trees, Stringy-barks, Ironbarks etc. *E. amygdalina* attains 480 ft., the highest tree in the world. *E. marginata* is the Jarrah wood largely imported for sleepers. Some species have proved very useful in Italy, Algeria and other places for drying up swamps and lessening mosquitoes and in California, on the other hand, for planting up areas subject to periodic droughts. *E. globulus* and others have succeeded well in the Madras Presidency.

The following species have been tried in this province, viz. *globulus*, *citriodora*, *tereticornis*, *rostrata*, *crebra*, and a few others. All these and others have been sown at Neterhat but only the first two germinated well. The species best suited to Bihar and Orissa have yet to be ascertained; so far I have only seen *globulus*, *citriodora* (a deliciously fragrant species) and *tereticornis* which have attained young pole stage. The following descriptions are chiefly compiled from Mueller's *Eucalyptographia*.

- I. Anthers mostly broader than long, usually reniform, opening by divergent upwards confluent slits. Umbels generally solitary 1. *amygdalina*.
- II. Anthers not or scarcely longer than broad, usually roundish, slits longitudinal. Umbels mostly paniculate 2. *crebra*.
- III. Anthers distinctly longer than broad, ovate to narrow oblong, slits longitudinal almost parallel. Umbels or fls. solitary.
- A. Flowers paniculate. Lid hemispherical 3. *maculata* (*citriodora*).
- B. Umbels solitary.
1. Umbels peduncled, several-fld.
Lid longer than tube with acute beak 4. *rostrata*.
Lid longer than tube with sub-terete obtuse beak 5. *tereticornis*.
2. Umbels subsessile, 1-fld. Fruit angular and warty 6. *globulus*.

1. *E. amygdalina*, Labill. The Giant Eucalypt. Probably the tallest tree in the world. Stems when growing freely are smooth and almost white. L. rather short-petioled, mostly alternate, narrow- or falcate-lanceolate, usually attenuate into acute oblique base, somewhat shiny. Umbels usually several-fld. short peduncled. Calyx attenuate into a thin pedicel. Ripe fruits small, semi-ovate.

2. *E. crebra*, F. v. Mueller. A very sweet-smelling species with dark rugged bark and slender drooping branchlets. L. alt. short-petioled, linear or falcate-lanceolate, rather thin, dull-green, very translucent-dotted. Filaments almost white. Fruit slightly attenuate at base. Germinated at Neterhat.

3. *E. maculata*, Hooker. Syn. *E. citriodora*, Hook. in *Mitch. Journ. Trop. Aust.* A tall handsome tree (or, loc. cit., a bush) with smooth somewhat shining whitish or reddish-grey bark mottled with the remains of the older bark. Seedlings rough with red-brown hair. Leaves scarcely shining. Branchlets slightly angular. Leaves shining or not, alt., linear-lanc. often somewhat falcate, sec. n. crowded, rather spreading, prominent with marginal nerve very close to edge, oil dots not very evident to sight. Fls. in short panicles, sometimes 2-3-nate on the panicle or solitary, pedicels shorter than calyx, calyx-tube short, lid double, inner transparent shining outer hemispheric pointed. Anthers oval-clavate. Fr. globose or sub-clavate, rim narrow, valves 2-4.

Mueller states that *E. citriodora* can only be distinguished from *E. maculata* as a variety differing in the exquisite lemon scent of its leaves and frequently finer-veined. The tree called *E. citriodora* thrives in Ranchi.

4. *E. rostrata*, Schlecht. The Red Gum.

A tall tree with smooth ashy grey or white bark and slender branches. L. alt. lanceolate-falcate, sec. n. crowded rather faint, dots scanty or obscure. Umbels lateral or supra-axillary, solitary on slender peduncles 4-14-fld. Calyx-tube semi-globose, lid longer with sub-hemispheric base then sharply beaked. Fruit sub-globose.

The timber is extraordinarily durable but less quick-growing than *E. globulus*. The tree will live in swampy land in Australia.

EUCALYPTUS.]

63. MYRTACEÆ.

5. *E. tereticornis*, Smith.

Closely allied to last. Leaves with more prominent sec. n. Umbels short-peduncled 4-8-fld. Lid often much elongated in a gradually tapering cone. Top of fruit more protruding.

The seedlings have opposite almost oval leaves. Timber excellent.

6. *E. globulus*, Labille. The Blue Gum.

A tall tree with smooth greyish- or bluish-white bark (except where persistent at base) with robust 4-angular branchlets. L. on old trees alt. (in seedling opposite sessile cordate or cordate-ovate), lanceolar-falcate, thick, sec. n. oblique not crowded, marginal rather distant from edge, dots inconspicuous. Fls. large axillary solitary rarely 2-3-nate, sessile, short and broad. Calyx glaucous, lid depressed hemispheric, warty-glandular, sharply umbonate, rarely as long as the obverse-pyramidal warty tube. Anths. oblong oval. Fruit rather large, hemispheric or obverse-pyramidal with broad rim and depressed or convex crown.

The young foliage is often very glaucous.

6. MELALEUCA, L.

1. *M. leucadendron*, L. Cajeput Oil Tree.

A m.s. usually tall and straight tree with almost white or ashy bark peeling off in large papery flakes, branches pendulous and somewhat willowy with lanceolate, somewhat oblique coriaceous aromatic leaves 2-5" long, tapering both ends and with 3-12 longitudinal nerves and short petiole. Flowers yellowish-white odourless in erect axillary spikes which are often proliferous. Calyx 15" long. Corolla 3" diam. Stamens numerous in 5 bundles opposite the petals. Ovary 3-celled with many ovules on peltate placenta. Capsule loculicidally dehiscent at the apex, subglobose, 2" diam.

Frequent in gardens. Native of the Malay Peninsula to Australia. Sometimes confused with *Eucalyptus* and *Acacia*.

7. CALLISTEMON, R. Br.

Australian Bottle-brush Trees. Trees or large shrubs, often with willowy foliage and often bright red or crimson small flowers conspicuous by being close together and sessile in a proliferous spike, the small dry fruits remaining for a long time clustered round the branches far below the terminal leaves. Hypanthium more or less globose or urceolate with deciduous dry sepals and caducous petals. Stamens very long usually brightly coloured, free. Ovary 3-4-celled, pubescent on the top which is depressed round the style. Ovules numerous on peltate placenta. Capsule opening by loculicidal small slits at the top.

1. *C. linearis*, D.C., with numerous bottle-brush-like tufts of brilliant crimson flowers and

2. *C. salignus*, Sweet, with small white flowers are both beautiful shrubs or small trees flowering in the hot weather and very common in gardens.

The last has a very hard wood.

FAM. 64. LECYTHIDACEÆ.

Trees (an undershrub in one of our species) with the characters of Myrtaceæ but without oil glands in the leaves and flowers, the leaves alternate and usually clustered towards the ends of the branchlets,

often toothed and usually without an intramarginal nerve or loops. Flowers usually large 4-6-merous, rarely 2-3-merous. Fruit a berry or fibrous or in exotic genera woody and opening by a stoppel.

The flowers of some of this family which are found in Calcutta gardens are exceedingly showy and interesting; such are *Napoleona imperialis* and *Couropita guianensis*. In the latter tree that part of the hypanthium bearing the androecium grows out sideways and then curves over the top of the flower so that an insect to get at the nectaries has to squeeze itself in between the two staminal (or staminodal in the case of some species) surfaces. To this family also belong the Brazil nut.

Flowers large in short spikes. Fruit baccate, many-seeded. . . 1. *Careya*.
Fls; m.s. in pendulous racemes. Frt. angular 1-seeded. . . 2. *Barringtonia*.

1. CAREYA, Roxb.

Trees or (*C. herbacea*) an undershrub with large leaves usually toothed and very large spicate or racemose flowers in few-fl. spikes or racemes. Hypanthium slightly produced beyond the ovary with 4 imbricate deciduous sepals. Petals 4 large white or pink. Stamens numerous, the outermost or innermost or both reduced to filiform staminodes, more or less connate at the base. Disc annular intrastaminal. Ovary 4-5-celled. Ovules numerous axile. Style long filiform. Fruit a large globose berry with numerous seeds.

1. *C. arborea*, Roxb. Kumb, Kumbi, H., Beng.; Asanda, K.

A small or m.s. tree with large obovate or obovate-oblong leaves clustered at the ends of the branchlets and large white and pink flowers in dense spikes succeeded by large globose green fruits 2.5-3" diam. crowned with the calyx-tube.

Throughout the province but chiefly in the moister regions and only found in the valleys of the Central Area. Fl. March or April-May. Fr. July. Deciduous Feb. to the time of flowering, old leaves often red or purple.

Attains 6 ft. girth in Angul where the largest trees are found, but no great height. Bark thick dark brown, rather smooth with exfoliating scales, blaze very thick red and fibrous. Leaves 6-15" long, glabrous, slightly crenate-denticulate, sec. n. 10-12 not very strong. Flowers with large bracts and bracteoles, sessile or scarcely pedicelled. Sepals ovate obtuse. Petals 1.75" cream or white. Filaments pink, very numerous. Ovary usually 4-celled.

Wood only used for fuel and agricultural implements. Brandis says weight variable but average about 50 lbs. The bark gives a fibre suitable for rough ropes. Campbell says that the fruit is eaten but I have not found this. The root is used to kill fish in Gangpur. Except in the grass lands of a damp district like Purneah (where the thick bark makes it tolerably fire resisting) the tree only thrives in shady forests, and though handsome there seldom looks well in a garden.

2. *C. herbacea*, Roxb.

An interesting little undershrub like a very dwarf "Kumbi" sending up annually from a woody rootstock reddish shoots with alternate glabrous obovate or oblanceolate serrulate leaves 3-4" long at time of flowering, ultimately 6-8" long, and large flowers 2.5" diam. with a disagreeable odour.

In open grass lands of Champaran! New shoots appear beginning of March and at once flower, but this is partly dependent on the time of firing the grass and they may appear up to May and June, or as early as January.

Leaves rounded at tip, vary attenuate at base into the short rather wider petiole. Flowers often sub-solitary. Bracteoles adnate to base of hypanthium. Sepals broadly-oblong 1.5" long. Petals oblong whitish or purple. Filaments pink below. Fruit (ripe?) 1.5" topped by the oblong rounded sepals .4" long.

2. BARRINGTONIA, Forst.

Trees with entire or toothed leaves mostly clustered towards the ends of the branches and large or m.s. flowers in terminal or lateral spikes or racemes with small deciduous bracts. Hypanthium ovoid or turbinate, calyx-tube hardly any, sepals 2-4 rarely 5 imbricate or valvate. Petals 4-5. Stamens connate at the base and tube also adnate to base of petals, anthers short versatile or sub-basal. Disc annular within the stamens. Ovary 2-4-celled with 2-8 ovules in each cell. Fruit pyramidal, ovoid or oblong, sometimes 4-angular, hard and fibrous when ripe, indehiscent, with one seed only. Embryo a thick fleshy hypocotyl with rudimentary cotyledons.

1. *B. acutangula*, Gaertn. Hinjal, Hijal, Beng., Or.; Ijar, Th.; Dundi, K.; Ingan, Kharw.; Hinjor, S.; Hyal or Hyar, H. (teste Buch. Ham.).

A small or m.s. tree with obovate or oblanceolate denticulate leaves attaining 9" by 4" but usually much smaller, narrowed into the 3-5" petiole. Flowers with pale pink very caducous petals but conspicuous from their bright red stamens and from being arranged in long drooping racemes often 2 ft. long. Fruit oblong quadrangular truncate about 1" long.

Usually on banks of streams but equally common both in the flooded parts and higher lands of Purneah and other swampy parts of Bihar. Singbhum! Manbhum! Gangpur! Athmallik! Puri! Angul! Sambalpur, along the Mahanadi! Rajmahal Hills (no doubt along streams) Kurz! Kalahandi! Fl. May. Fr. Sept. Evergreen or nearly so, renewing leaves March-April.

Sometimes attaining 5 ft. girth but always with short trunk. Bark thick dark grey distinctly furrowed on old trees, blaze pink with cheesy cut. Leaves usually 3-5" with about 10 sec. n. and very reticulate intermediate venation, rather pale beneath. Racemes lax, pedicels 2-3". Hypanthium acutely 4-angled obpyramidal. Sepals 1" denticulate. Petals 2".

"Wood pale or reddish brown, tough and strong. Wt. about 40-50 lbs. Used for boat-building, wells, carts, rice-pounders and by cabinet-makers." Brandis.

FAM. 65. MELASTOMACEÆ.

Herbs or shrubs, rarely small trees, with opposite or whorled entire, rarely serrulate, exstipulate leaves which are usually 3-7-nerved from or from near the base (exc. in Memecyleæ), the nerves extending nearly to the apex. Flowers small or often very showy regular or somewhat irregular in the andrœcium, 2-sexual. Hypanthium usually united by vertical walls to the ovary, sometimes wholly adnate, rarely nearly free, bearing 3-6 sepals or truncate. Petals as many as sepals, contorted in bud. St. as many or more than the petals and inserted with them on the margin of the hypanthium, filaments bent inwards in bud, alternate stamens sometimes different or rudimentary, anthers opening by terminal pores, rarely by slits, connective often appendaged at the base. Ovary 3-6- usually 4-5-celled or (in Memecylon) 1-celled, style simple. Ovules very many except in Memecyleæ, axile in the Melastomeæ, free central in Memecyleæ. Fruit baccate or capsular, opening by pores in the top or

sometimes irregularly breaking up. Seeds minute and numerous (exc. *Memecylon*), albumen 0, cotyledons usually short.

- I. Sub-family Melastomeæ. Ovary 3-6-celled. Ovules very many on axile radiating placenta. Seeds very many. Anthers opening by a pore.
 - A. Flowers 4-5- rarely 6-7-merous, not spicate.
 - Stamens all similar 1. *Osbeckia*.
 - Stamens dimorphous 2. *Melastoma*.
 - B. Flowers 3-merous, in scorpioid spikes 3. *Sonerila*.
- II. Sub-family Memecyleæ. Ovary 1-celled, ovules about 9 on a free short central placenta. Berry 1-seeded. Anthers opening by pores or short slits. Stamens 8 similar 4. *Memecylon*.

1. OSBECKIA, L.

Shrubs or herbs with usually 4-angled branches and frequently strigose hispid or with stellately-hairy or setose scales. Leaves opp. or ternate. Fls. terminal capitate or paniced, more rarely solitary, 4-5-merous. Hypanthium with stellate hairs or pectinate scales. Stamens equal or subequal and similar with oblong anthers which may be more or less beaked, connective not produced at the base, slightly swollen or with 2 tubercles. Ovary setose at the apex with very numerous ovules on placenta radiating from the axis. Capsule opening by 4-5 pores at the top. Seeds curved through half a circle, covered with minute elevated points.

A genus of very pretty herbs or shrubs most of them suitable for a garden.

- I. Perianth 4-merous.
 - A. Anthers not or scarcely beaked.
 - Hairs spreading. Fls. capitate with an involucre of leaves 1. *truncata*.
 - Hairs appressed. Fls. 1-3 not capitate 2. *zeylanica*.
 - B. Anthers distinctly beaked.
 - Hyp. not necked. Herb under 2 ft. Fls. capitate 3. *chinensis*.
 - Hyp. long-necked in fruit. Herb 3-5 ft. Fls. paniced 4. *rostrata*.
- II. Perianth 5-merous (rarely 4-merous in *nutans*).
 - Small wiry shrub 2-3 ft. Fls. cernuous 1" diam. 5. *nutans*.
 - Shrubby 4-5 ft. Fls. not cernuous 1.5" diam. 6. *nepalensis*.

1. *O. truncata*, Don.

An erect herb slender 4-12" high with spreading hairs on the 4-angled stem, elliptic or ovate sparsely hairy leaves .5-1.3" and very small usually 4-merous pale purple flowers capitate at the ends of the stem or branches. Hypanthium .1-.15", 8-ribbed and stellately pilose. Sepals 4 very small .05" or less triangular and cuspidate persistent alternating with branched hairs which are as long. Anthers not beaked. Fruit .15-.2" with the hairs persistent.

In wet places, not nearly as common as *O. chinensis*. Ranchi! Manbhumi, Camp! Gaya, below the ghats (Pathra forest)! Angul, Chatrajee! Fl. r.s. Fr. Nov. Easily recognised in flower by the very small petals not exceeding .1-.15". Lower leaves shortly petioled, upper sessile. Inflorescence supported by 3-4 large leaves.

Var. *Kurzii*. Plant scarcely 2" with very small leaves and flowers and ribs on fruit absent.

Parasnath 4200 ft., Kurz!

2. *O. zeylanica*, Willd. Var. non-rostrata.

A very small herb 2-3" high with the stems strigosely hispid on the angles, small elliptic or oblong leaves .3-.4" thinly strigose above

with stout hairs ending in a capillary tip, a continuous row of especially stout adpressed hairs near the margin. Fls. mauve '5" diam., not capitate, few, usually about 1-3 at or towards the ends of the branches on pedicels '05-'07" long. Hypanthium 8-ribbed setose. Sepals lanceolate '15" spreading with long-stalked stellate hairs between. Anthers 8 scarcely beaked. Fruit ovoid setose.

Sands of the Orissa coast, Puri! Chilka Lake (called *O. truncata* in *Herb. Cal.*), *Alcock!* Fl. March.

This differs from the type essentially in the anthers not being beaked. A specimen of *O. zeylanica*, however, collected by *C. E. C. Fischer* in the Anaimalai Hills has only short beaks. The other characters in which it differs such as the very small leaves and few flowers are no doubt the immediate result of its habitat.

3. *O. chinensis*, L.

An erect herb 6" to 2 ft. high with linear linear-lanceolate or oblong leaves 3-5-nerved appressed-hairy both sides and usually 4-merous mauve-coloured flowers about 1" diam. capitate at the top of the branches. Hypanthium urceolate not ridged, glabrous except for stellate bristles between the sepals, or with a few hairy stipitate scales, often shining in fruit. Anthers with a long beak.

Common in wet places all over the Northern and Central Tract, especially on the mountains! Chota Nagpur, common usually on damp clay soil in grass! *Angul, Chattarjee!* Fls. Aug.-Nov.

Stems 4-angled, sparsely strigosely hairy. L. 1-2'5" rarely more, margin often obscurely serrulate. Sepals lanceolate glabrous ciliate. Fruit glabrous, '15-'2" wide with apical bristles.

Var. *parasnathensis*. Erect, 2 ft., leaves oblong 2" with sub-cordate base. Fruit often '25".

Parasnath!

4. *O. rostrata*, Don.

A stout herb 3-5 ft. high, scarcely branched, with opposite or ternate ascending distant leaves 3'5-'7" long with 5-7 principal nerves and numerous distinct obliquely scalariform secondary nerves. Petioles '2-'4". Flowers in oblong or pyramidal terminal panicles 4-'7" long at the top of the stem, purple, with petals '5-'7" long. Hypanthium glabrous or thinly setose '3" long, ovoid oblong with a neck (bottle-shaped), glabrous or setose '4-'5" long in fruit.

Fl. Aug.-Sept. Fr. Oct.-Dec.

The following two very distinct varieties occur in the province :—

Var. *pulchella*, Benth.

Stems glabrous 4-angled or -winged. L. oblong or oblong-lanceolate acute or sub-acuminate up to 2'5" broad, glabrous beneath between the nerves, hispid above. Fruits '5". Seeds small white with lines of minute dots.

Purneah, in wet ground and swamps!

Var. *sexangulata*, Haines.

Stems strigosely hirsute with bulbous-based hairs, 6-angled. L. lanceolate or narrowly lanceolate up to 1'3" broad setosely hairy on both surfaces. Petiole densely strigose. Fruit '3-'4". Seeds very small orange yellow conchoidly granulate.

Chota Nagpur 3000 ft. in wet places!

The type has 4-angular stems, glabrous or with patent hairs, and corymbose flowers.

5. *O. nutans*, Wall.

A pretty little much-branched wiry shrub 2-3 ft. high with narrowly lanceolate 3-nerved leaves 1-1.8" long glabrous and sometimes golden between the strigose nerves beneath, glabrous and beautifully lineolate above when dry. Flowers 4-5-merous, pale rose-coloured, about 1" diam. on cernuous pedicels 1-2 together on short axillary and terminal peduncles. Hypanthium glabrous, globose, .2-.25" diam. Sep. .3" lanceolate, ciliate at base and with pectinate scales between. Free part of ovary and fruit densely strigosely hairy.

Sub-montane tract, along rivers, N. Champaran! Fl. Oct.-Dec. Fr. Nov.-Jan. Branches strigose. Petiole mostly under 1".

C. B. Clarke says (*P.B.I.*, p. 516) that "there is no recorded instance of a normally 5-fid *Osbeckia* producing 4-fid flowers"; this, however, was the case with the first specimens of *O. nutans* collected by me.

6. *O. nepalensis*, Hook.

A branched shrub 4-5 ft. somewhat resembling *Melastoma malabathricum* when not in flower but the leaves softly hairy on both surfaces. Flowers in corymbose panicles white (or mauve-purple, *F.B.I.*), 1.5" diam. Hypanthium with large flat permanent scales pectinate with white bristles and a ring of the same round the top, truncate in fruit. Sepals broad lanceolate .4" ciliate. Fruit campanulate (not bottle-shaped) or urceolate, free top short opening by 5 terminal pores densely strigose and with a 5-crenate ciliate crown.

N. Champaran, Bettiah and Ramnagar! N. Purneah, in open grassy jungles! Fl. Oct.-Dec. Fr. Nov.-Dec.

Stems acutely 4-angled strigose. L. lanceolate acuminate subsessile, larger 5.5" by 1.7", principal nerves 3 and 1-2 weaker ones each side.

2. MELASTOMA, L.

Strigose or villose shrubs with 3-7-nerved leaves and 5- (rarely 6-7-) merous flowers. Hypanthium with simple hairs or scales. Sepals deciduous. Stamens twice as many as the petals, alternate ones longer with purple anthers and connective produced at base terminating in two lobes, the intermediate shorter ones with yellow anthers not produced but with two tubercles in front. Ovary as in *Osbeckia*. Fruit baccate or coriaceous, bursting irregularly. Seeds as in *Osbeckia*.

1. *M. malabathricum*, L. Dantgigiri, Th.; Gongai, Or.; Phutki, H.

A beautiful very bushy shrub 4-5 ft. or sometimes 7 ft. high with 4-angled branches densely strigosely-scaly twigs and 3-7-basal-nerved, rough, broadly lanceolate, oblong-lanceolate or elliptic leaves 3-4" long. Fls. bright mauve-purple 1-1.5" diam. in clusters of 1-5 at the ends of the twigs with conspicuous yellow stamens. In fruit the hypanthium becomes rather brittle and breaks usually transversely, while the placenta become very fleshy and purple.

Throughout the area, but especially common in the Northern area north of the Ganges. In the Central and Southern area restricted to the more shady valleys and water courses. Fl. March-May. Fr. Nov.-Dec. Evergreen.

Leaves strigose with stout scabrid hairs beneath and somewhat similar hairs adnate their whole length to the epidermis above. Petiole .3-.5". The hairs (so

MELASTOMA.]

65. MELASTOMACEÆ.

usually described) on the hypanthium and other parts are rather scales, consisting of very numerous cells and sometimes minutely toothed and with a mid-rib.

The mass of sweetish fleshy placentæ and seeds is eaten and stains the teeth purple.

3. SONERILLA, Roxb.

Small herbs, sometimes woody at the base, sometimes stemless. Leaves in a pair sometimes unequal, 3-5-nerved, entire or serrulate. Fls. in racemes or scorpioid spikes with campanulate or a long-funnel-shaped hypanthium and 3 short sepals, 3 petals and 3 stamens (rarely 6), anthers without appendage to connective. Ovary 3-celled, apex glabrous. Fruit a capsule usually 3-gonous and 6-ribbed opening at the top by 3 valves. Seeds very many smooth or minutely tuberculate or punctate, raphe simple or running out into a lateral appendage, sometimes overtopping the seed.

1. *S. tenera*, Royle.

A delicate little plant 2-8" high with often pink stems more or less pubescent and gland-hairy. Leaves membranous ovoid, elliptic or rhomboid 3-5-nerved, larger 1.25" by .75", sometimes obscurely toothed narrowed into the short petiole, sometimes with long sparse hairs above. Racemes or spikes 1-2", only about one flower opening at a time. Fls. .3" long. Sepals broad ovate short cuspidate. Petals pink, clawed, broad-oblong, suddenly acute. Ovary with very thin wall slightly adherent to the hypanthium which is sparsely gland-hairy.

Frequent on moist banks in the hills of Chota Nagpur. Singbhum! Hazaribagh, ascending to top of Parasnath! Neterbat! Fl., Fr. Oct.-Nov.

4. MEMECYLON, L.

Shrubs or trees with short-petioled or sessile coriaceous glabrous leaves which are usually penninerved. Flowers in small lateral, rarely terminal, cymes or umbels, often clothing the branches from the axils of fallen leaves. Hypanthium campanulate, sepals 4 short or 0. Petals 4 usually blue or white. St. 8 similar with short anthers opening by slits in front, connective with an empty spur or horn behind. Ovary inferior 1-celled enclosed in the hypanthium and with an 8-rayed disc at the top, style filiform, ovules 6-12 on a free central placenta. Fruit baccate but only 1-seeded. Seed large with convolute cotyledons.

1. *M. edule*, Roxb. Var. *ovata*, Clarke. Niras, Or.

A very beautiful shrub or small tree with ovate acuminate leaves 3 by 1.8" to 5.5" by 2.8" with rounded base and very obscure secondary venation. Flowers bright blue .25" diam. very numerous in clustered compound umbellate cymes not exceeding 1" long from the old leaf axils. Hypan. pink, shortly tubular-campanulate then spreading and saucer-shaped with 4 shallow rounded sepals, disc beautifully veined with 8 radiating lines united by a marginal one. Pet. 4 blue fugacious broadly ovate. St. blue. Berry .3-.4" diam., blue or dark-purple.

Along rocky ravines and on the tops of high rocky hills in Orissa. Baruni and

Kaburi hills and ravines in Southern range, Puri! Ravines in Angul! Rarely also in scrub jungles! Fl. April-June. Fr. June-July. Evergreen.

Attains 2 ft. girth with closely regularly fluted corky bark and hard deep-brown then pale brown blaze, in young trees thin pink and dirty white. L. rarely only 2.5", acute or obtusely acuminate, with minute black dots beneath, sec. n. 6-9 (fairly distinct in Angul specimens). Petiole .25-.4". Cymes (only .3" long in some Khurda plants) 1-many from a node with 4-angled peduncles .25-.4" long. Fl. buds white very acute.

The berries are eaten.

FAM. 66. LYTHRACEÆ.

Trees, shrubs or herbs, often with 4-angled branches. L. entire, usually opposite, sometimes whorled or alternate, exstipulate, sometimes dotted. Fls. from minute to very large, 2-sexual, regular or somewhat zygomorphous (distinctly in *Woodfordia*) perigynous with the hypanthium growing up around but free from the ovary (exc. *Punica*) though often adherent and accrescent in fruit, generally 3-6-merous. Sepals 3-6, valvate, sometimes with an epicalyx of smaller intermediate sepals (or bracts?). Petals as many as the sepals or 0. St. definite or indefinite perigynous, inserted in the hypanthium or on its throat. Ovary 2-6-celled with long simple style and usually capitate stigma. Ovules very many on large axile, rarely parietal placentæ. Fruit membranous, coriaceous or capsular, sometimes 1-celled by absorption of the septa. Seeds many exalbuminous, sometimes winged. Embryo straight (exc. *Sonneratia* and *Punica*).

In the *Nat. Pflanz. Fam.* *Sonneratia* (under the name *Blatti*) is placed in a separate family (*Blattiaceæ*) and *Punica* is placed in another family consisting of the single genus. The last is the most natural arrangement, but as *Punica* is not indigenous in our area it suffices to include it here.

I. Lythraceæ. Flower perigynous. Ovary cells in one whorl.

A. Trees or shrubs. Flowers often large.

1. Flowers distinctly zygomorphous, hypanthium coloured 1. *Woodfordia*.

2. Flowers regular.

a. Ovary not adnate at base with hypanthium, 2-6-celled, placentation axile.

Flowers 4-merous.

Fls. 3- or 6-merous, rarely perianth 7-9-merous.

St. α

b. Ovary more or less adnate at base to hypanthium, 10- or more-celled.

B. Herbs with small or minute flowers sometimes apetalous.

II. Punicaceæ. Flowers epigynous. Ovary multi-cellular in two whorls.

1. *Woodfordia*.

2. *Larsonia*.

3. *Lagerstræmia*.

4. *Sonneratia*.

5. *Ammannia*.

6. *Punica*.

1. WOODFORDIA, Salisb.

A shrub, a single species characterised generally by the cymose tubular flowers which are distinctly zygomorphic with a curved coloured hypanthium somewhat dilated above with oblique mouth, 6 greenish tooth-like sepals, 6 very small scarlet petals and an epicalyx of 6 scales. Stamens 12 inserted below the middle of the hypanthium declinate and of two different lengths in any one flower (fls. trimorphic as in *Lythrum salicaria*, cp. Darwin's *Different Forms of Flowers*). Ovary free oblong 2-celled with filiform style. Fruit dry with thin walls irregularly breaking. Seeds very many, narrowly cuneate-obovate, smooth.

66. LYTHRACEÆ.

1. *W. fruticosa*, Kurz. Syn. *W. floribunda*, Salisb.; *Lythrum fruticosum*, L.; *Icha*, K. & S.; *Phuldawai*, Dhai-phul, *Kharw.*; *Dadki dhatuli*, dhauri, *Vern.*

A much-branched beautiful shrub when in flower with sessile or sub-sessile linear-lanceolate acuminate distichous leaves 2.5-4" long, silvery, finely pubescent and dotted beneath, and brilliant scarlet flowers .5-.75" long in fascicled cymes axillary and from the old wood, often completely covering the branches.

A very common shrub except in the plains, chiefly on clay soils in open and second-growth forest, sometimes gregarious. Fls. Jan.-April. Fr. April-May. Nearly leafless end of Feb. and in March when the flower is at its best, leaves often not renewed till end of May in dry localities.

The germination is epigeal but the seedlings most minute with cotyledons the size of a pin's head. I have germinated and grown the plant very successfully by sowing it in heaps of brick rubble which is kept damp.

The flowers yield a dye which is yellow or pink. *Paranjpe* states that it is the dye so familiar during the Holi. Both the flowers and leaves yield a large percentage of tannin. The dried flowers are given with "dhai" in dysentery. On account of the tannin also the powdered flower is sprinkled over unhealthy sores and ulcers. It is a favourite flower among the Kols who wear it in their hair and often mention it in their songs.

2. LAWSONIA, L.

A large shrub or small tree with terete often thorny branches, glabrous. Leaves opposite. Flowers rather small in terminal paniced cymes. Hypanthium short cupular. Sepals 4 ovate. Petals 4 obovate, wrinkled. Stamens 4 or 8. Ovary 4-celled or 4-celled at base with many ovules on axile placentæ. Fruit dry coriaceous exserted from the hypanthium, globose, irregularly breaking up and finally 1-celled. Seeds many angular, smooth.

1. *L. inermis*, L. Syn. *L. alba*, Lamk.; *Mehndi*, *H.*; *Benjati*, Or.; *Henna*.

A small tree 20 ft. high or large shrub with branches often ending in thorns, lanceolate or narrow-rhomboid small leaves .9-1.5" very shortly petioled with few rather inconspicuous sec. n. Fls. .25" diam. very fragrant, cream-coloured. Fruit red when young, ultimately dry and seated on the hypanthium with the persistent small sepals, depressed globose, .25-.3" diam. crowned with the style.

Not uncommon in hedges. Ranchi! Palamau! Gaya! Sambalpur! Fl. Oct.-Nov. Fr. Nov.

Yields the Henna dye.

3. LAGERSTROMIA, L.

Trees or shrubs with opp. or sub-opp. distichous entire leaves and usually showy flowers in axillary and terminal panicles. Sepals and petals 6-9 on the margin of the cupular or tubular hypanthium; petals very long-clawed, wrinkled, crisped or erose. Stamens very many, inserted near the base of the hypanthium and more or less hypogynous, with long often-curved and barren filaments. Ovary 3-6-celled. Capsule 3-6-valved and -celled, girt by the persistent calyx. Seeds winged at the apex, flat, erect.

Hypanthium strongly ribbed. Fls. large, mauve 1. *flos regina*.
 Hyp. not ribbed. Fls. 1.5-2" diam., colours various 2. *indica*.
 Hyp. not ribbed. Fls. .5" diam., white 3. *parviflora*.



1. *L. flos-reginæ*, Retz. Kwiri, M.; Gara Sekre, Ho.; Jarul, Beng.; Patoli, Or.

A large or m.s. tree but often flowering when only 20 ft. high. Leaves elliptic to lanceolate 4-8" long, glabrous, with rounded base and 6-12 sec. n. Petiole very short. Flowers 2-3" diam. mauve-purple in long narrowly-pyramidal panicles sometimes a foot long. Hypanthium semi-spherical with alternate strong broader and narrower ribs sometimes slightly produced as teeth beyond its margin (rudimentary epicalyx). Capsule septifragally 5-6-valved, woody, 1-15" diam. subglobose.

Along the larger rivers and muddy side-nalas in Singbhum! Gangpur! Bonai, Bonairgarh, rare, *Cooper*! Banks of Mahanadi, Angul! Cuttack and Balasore, near the canals, indigenous? Puri (Jaganathprachad Forest), *Haslett*! Often planted and a very handsome tree when covered with its large panicles.

Fl. end of April-June. The capsules remain on the tree till the following flowering season. Evergreen.

Bark nearly smooth, peeling off in flakes, grey. Although an important timber tree in Assam it occurs too sparingly in this province to be of much value.

2. *L. indica*, L. Farash, Telinga-china, H.; Crepe Plant or Crepe Myrtle.

A very beautiful shrub attaining 15 ft. with elliptic or oblong sessile glabrous leaves acute or sub-obtuse about 1-3" long and very numerous panicles of white, lilac or rose-coloured flowers 1-1.5" diam. Hypanthium not ribbed, with triangular sepals and long-clawed petals. Fruit sub-globose 3" diam.

Very common in gardens. Fl. May-July. Deciduous in c.s. Native of China.

3. *L. parviflora*, Roxb. Asidh, Th.; Sekre, K., S.; Sidha, Beng.; Lendia, Senha, Gond.

A tall tree or sometimes a small tree or shrub, with narrowly elliptic or oblong or ovate-lanceolate acute or acuminate distichous leaves 2-3.5" and delicate white flowers in 3-chotomous panicles with petals .25" long. Hypanthium cupular smooth, woody in fruit and embracing the capsule which is .75-1" long ellipsoid and polished. 3-, sometimes 4-valved.

Throughout the whole province, attaining its largest size in the sub-Himalayan districts and again in Angul and the better forests of the Orissa States, small in the dryer Chota Nagpur forests and, indeed, frequent in scrub jungles. Fl. April-May. Fr. Dec.-Jan. Decid. Feb.-March and flowers on the new shoots.

Attains 6-8 ft. girth with grey or reddish smooth bark, stripping off in long narrow flakes in old trees, blaze light brown. Young branches often 4-winged. Foliage with a grey or glaucous appearance, the young leaves hoary beneath with a very fine tomentum, old coriaceous, glabrous or shortly pubescent beneath with 6-10 sec. n. Cyme branches and pedicels very slender often 2-5-nate, bracts linear. St. few long and many short.

Var. *majuscula*, Clarke. Leaves glabrous larger, sometimes 4-5" by 2", fruit larger, sometimes exceeding 1.5 by 1".

The small tree of Chota Nagpur appears mainly to belong to this variety which seems to be a form of dry uplands.

It is one of the poles most in demand for house-posts and other timber for native buildings. It is also much used for agricultural implements. The fuel, including charcoal, is good. *Gamble* gives the weight as 53 lbs. The gum is said to be edible.



66. LYTHRACEÆ.

4. SONNERATIA, *L.f.*

Petals 0.	Stigma very large mushroom-shaped	.	.	.	.	1.	<i>apetala</i> .
Petals 6.	Stigma capitate	.	.	.	.	2.	<i>acida</i> .

1. *S. apetala*, Ham. Keora, Kerua, Or.

Common in the tidal forests of the Mahanadi delta! Fl. Feb.-May.

Often 4 ft. girth with grey-green bark on young stems, blaze with chlorophyll then white and brown, bark of old trees dark-grey and rough below, blaze hard dark crimson. Pneumatophores with exfoliating bark. Leaves attenuate at base into a '2-25" petiole.

The wood is not much used but is said to be used in the Sunderbans for planking and for fuel. The fruit boiled till it is soft is cut in half and is used as a fish bait.

Gamble says that the bark is black! He gives the weight of the wood as about 40 lbs.

2. *S. acida*, L. Ora, Beng.

A small tree about 20-25 ft. with broadly obovate or sub-orbicular more rarely oblong leaves 2.5-3.5" long, pale beneath, sec. n. fine but distinct, about 10, base narrowed into the very short petiole. Fls. over 2" diam. with large calyx 1.3" long (including the hypanthium). Petals linear. 6. Capsule globose much depressed often 2" broad.

Tidal forests of the Mahanadi delta! Fl. June-July. Fr. Aug.

Bark white and blaze white but rather darker on the wood. Pneumatophores corky. Inflorescence articulate.

The above is somewhat doubtful. The tree was not in flower and the flower is described from a Bombay specimen. As the species occurs in the Gangetic delta there is, however, considerable probability of its occurring in Orissa.

5. *AMMANNIA*, L.

Small annual herbs growing in wet places, with branches frequently 4-angular. L. opposite or upper alternate, rarely whorled, entire. Flowers small or minute axillary solitary and sessile or in spikes or small axillary cymes, bracteoles 2 sometimes minute. Hypanthium tubular or campanulate with 4-5 rarely 3 small sepals and sometimes small intermediate folds or teeth (epicalyx). Petals 5-1 or 0, inserted between the sepals, a small annular disc rarely present inside the petals. St. 3-8 rarely 2, inserted usually near the middle of the hypanthium. Ovary free, 3-5-celled or by absorption of the septa 1-celled. Ovules very many axile. Capsule thin-walled 2-4-valved or more or less irregularly dehiscent or circumsciss. Seeds many.

minute, usually rounded on the back and concave or flat with a low rim on the face, rarely angled.

The genus is sometimes divided into three: *Rotala*, *Ammannia* and *Nesaea*. In the first two the central axis with placentæ is not continuous with the style and in *Nesaea* it is. In *Rotala* the capsule opens by valves and in the last two it is said to rupture irregularly or circumscissilely, but in some species of *Ammannia* the valves are nearly regular.

- I. Flowers solitary in the axils of leaves or bracts. Capsule valvular.
 - A. Flowers distinctly spicate, spikes peduncled terminal. Fls. pink.
 - L. small orbicular. Hyp. campanulate. Pet. twice sep. 1. *rotundifolia*.
 - L. ell. or ovate. Hyp. tubular. Pet. smaller 2. *tenuis*.
 - B. Fls. axillary or spikes axillary, not peduncled.
 1. Hypanthium tubular. Ovary and capsule oblong.
 - Stems ascending. L. obovate, margined '5-7" 3. *indica*.
 - Stems prostrate. L. linear '2-3". Sepals 5 4. *dentelloides*.
 2. Hypanthium campanulate. Ovary usually 3-lobed. Capsule as broad as long.
 - a. Procumbent cæspitose herb. L. linear under '3" Sep. 4 5. *pygmæa*.
 - b. Ascending or erect herbs. L. oblong or lanceolate over '3".
 - Fls. mostly 4-merous. Epicalyx 0, petals yellow 6. *densiflora*.
 - Fls. 5-merous. Epicalyx conspicuous. Petals pink or 0 7. *pentandra*.
- II. Flowers cymose or clustered axillary.
 - A. Clusters or cymes sub-sessile.
 - L. tapering at base 8. *baccifera*.
 - L. rounded or cordate at base 9. *salicifolia*.
 - B. Cymes distinctly peduncled.
 - Capsule much exceeding hypanthium '1" long 10. *senegalensis*.
 - Capsule hardly exceeding hypanthium, '05" long 11. *multiflora*.

1. *A. rotundifolia*, Ham. Sim-sindur, S.

A very pretty little herb forming carpets of magenta or pink when in full flower with very numerous erect branches 3-6" high from a creeping stem. Leaves sessile orbicular or broadly elliptic rounded each end '2-5" long. Fls. in the axils of small foliaceous bracts in dense terminal often 3-nate spikes. Hypanthium campanulate. Petals conspicuous twice as long as the sepals. Capsule 4-valved ellipsoid. Seeds ellipsoid peltate.

Common in wet places especially by the marshy sides of streams, gregarious. In all districts, ascending to the tops of the mountains! Fl., Fr. Jan.-May.

The flowers are dimorphic in respect to the length of stamens and style (*teste* C. B. Clarke).

2. *A. tenuis*, Clarke. Syn. *Ameletia tenuis*, R. Wight.

A little plant resembling *A. rotundifolia* but far more delicate and less showy. Leaves '1-25" elliptic or ovate, often acute. Spikes on very slender peduncles with oblong or lanceolate bracts, hypanthium narrowly funnel-shaped or tubular with acute lanceolate sepals and with large bracteoles at the base about three-fourths its length. Petals lanceolate-obovate only slightly exceeding the sepals. Capsule 2-valved.

Behar, Kurz? J.D.H. ! Fl., Fr. Oct.-Dec.

3. *A. indica*, D.C. Syn. *A. peploides*, Spr., *Rotala indica*, Koehne.

An erect succulent herb 5-12" with decumbent often rooting base and quadrangular stems and branches. Leaves often close, elliptic-

obovate or elliptic with attenuate base, sessile, 3-7", distinctly margined, tip rounded or obtuse, sec. n. 4-6 rather prominent beneath. Fls. very pale pink narrowly campanulate, solitary axillary on very short spiciform axillary branches with reduced narrow-oblong leaves (or bracts), base of bract also often pinkish. Bracteoles linear setaceous 1" long, i.e. about as long as the flower. Sepals lanceolate acuminate 4 exceeding the very minute petals, or petals 0. Ovary oblong. Capsule ellipsoid or oblong about as long as hypanthium, 2-valved. Seeds "narrow oblong sub-falcate, pink," *Clarke*.

Rice fields and wet places, common. Singbhum! Ranchi! Parasnath, Prain! Bettiah, Hieronymus! Angul, Chattarjee! Probably in all districts. Fl., Fr. Oct.-Dec. or up to Feb. in moister situations.

4. *A. dentelloides*, Kurz.

A small procumbent weed with stems 2-4" long and opposite linear leaves 2-3" long. Fls. axillary. Hypanthium tubular-campanulate 5-ribbed with 5 triangular sepals minutely thinly puberulous. Petals minute. Capsule ellipsoid 2-valved.

Found in the Sikkim Tarai and probably Purneah. A note in the *Calcutta Herbarium* also says Parasnath, Kurz, but I can find no Parasnath specimens.

N.B.—Koehne, in *Das Pflanzenreich*, states that this is a *Scropulariaceae*: cp. *Microcarpaea muscosa*.

5. *A. pygmæa*, Kurz.

A very small and slender but cæspitose weed 1-3" high or decumbent branches up to 5", with linear leaves 1-25" long and most minute flowers in their axils. Bracteoles shorter than the flower filiform or as long as the 0.2"-long campanulate hypanthium. Sepals 4 rarely 5. Petals 0. Stamens 2 rarely 3-4. Capsule broadly ellipsoid before dehiscence then about as broad as long, 2-valved or 3-valved. Seeds concave white, brown or black.

Frequent on damp ground and sometimes inside the forest. Ranchi! Singbhum! Parasnath, Clarke! Manbhum, Ball! Santal P., Kurz!

It sometimes forms green mats in the damp beds of talas. Fl., Fr. Nov.-Jan.

6. *A. densiflora*, Roth. Syn. *Rotala densiflora*, Koehne.

General habit of *A. peploides*, 6-16" high. Leaves oblong or oblong-lanceolate sub-amplexicaul with cordate base decurrent as four wings on the stems, branches, and spikes, cauline 5-1", upper smaller with more acute base and passing into bracts, tip rounded, scarcely tapering, sec. n. distinct. Fls. on the short spiciform axillary branches but these sometimes elongate as in *A. pentandra*, bracts 1-2", scarcely tapering, pink at the base. Fls. solitary 0.5-0.6" long, pink, with yellow tubular-campanulate hypanthium and minute bracteoles only one-third as long; sepals 4, very rarely 5 (3-6 Koehne), pink, very broadly ovate then suddenly acute, petals 0-4 (3-6 Koehne), but usually 1, yellow. Stamens inserted below middle of tube. Ovary 3-lobed microscopically trabeculate, style short but half as long as ovary or longer. Capsule nearly as broad as long.

Wet ground, Purneah! Fl., Fr. Dec.

Perhaps only a variety of the next, the length of the style being a bad character.

7. *A. pentandra*, *Roxb.* Syn. *Rotala leptopetala*, *Koehne*, and *R. densiflora*, *Koehne*?

An erect weed 4-15" high, in robust specimens pyramidal with very numerous spreading branches. Lower leaves oblong or lanceolate acute from a broad sessile sometimes cordate or truncate (subcuneate or contracted, *Koehne*) base, .5-1.3" long, smaller upwards and becoming bractiform with a sessile flower in every axil, sec. n. obscure, bases decurrent as angles or wings but branches less alate than in the last species. Floriferous branches often elongate (and when at the same time the main cauline leaves drop the plant looks different and is apparently the *Rotala illecebroides*, *Koehne*). Bracteoles acicular as long as or nearly as long as the flower. Fls. pink .1" long with broadly campanulate hypanthium. Buds depressed acutely 5-angled, sepals usually 5 broadly triangular, often finely acuminate, intermediate teeth (epicalyx) distinct spreading acicular. Petals usually present pink elliptic-oblong above the claw, obtuse or retuse, twice the sepals. Disc often prominent annular and 5 stamens from inside the disc when present. Ovary prominently 3-lobed, sub-globose style scarcely longer than stigma, capsule globose, 3-valved.

Wet ground, especially on clay soils, very common throughout the province. Often turning red when the ground dries up. Fl., Fr. July-Jan.

8. *A. baccifera*, *L.* Syn. *A. vesicatoria*, *Roxb.*

Erect, stout for the genus, 6"-2 ft. high with square stems and opposite leaves below, often alternate above, lower narrowly elliptic-lanceolate tapering both ends, attaining .3" by .6" but often only .3" on depauperated plants, successively smaller upwards. Flowers minute green pedicelled, in few-fl'd or dense axillary usually umbelliform cymes under .2" long, turning red in fruit. Buds 4- or 8-angled often like two equal pyramids placed base to base with the four corners somewhat subulate-mucronate (intermediate folds or epicalyx). Hypanth. broadly campanulate or obconic with 4, rarely 5, broadly triangular sepals, petals 0 (or small, *Clarke*), stamens 4 with very short filaments. Capsule depressed-globose exceeding the calyx and red in fruit, circumsciss, 1-celled.

In rice fields and wet places throughout the province. Fl., Fr. r.s. and c.s. A plant from a marsh in Porahat was 3 ft. high, with very few-fl'd. cymes, but it was young and old cymes become more and more congested until, as *Clarke* says, they appear as knots on the branches. *Roxburgh* says that the leaves are exceedingly acrid and are largely employed as a vesicant.

9. *A. salicifolia*, *Monti*, is scarcely more than a variety of *A. baccifera* distinguished by the leaves not tapering at the base but rounded or sub-cordate. They sometimes attain 3" in length.

Behar, *J. D. H.*

10. *A. senegalensis*, *Lamk.*

An erect weed 6"-2 ft. high with sharply 4-angled branches, Larger leaves attain 1-2", linear-oblong or linear-lanceolate from a broad sub-hastate base. Fls. in axillary peduncled cymes which attain .5-.7" in length but are shorter than the subtending leaves. Hyp. tubular-campanulate with green ribs, sepals 4 broadly tri-

angular and intermediate ribs sometimes excurrent as teeth (epicalyx). St. 6-8. Fruit globose. 1" diam.

Purneah, *Kurz*! Upper Gangetic Plain (and therefore probably extending throughout the Northern area), *Duthie*! Fl., Fr. r.s. and c.s.

11. *A. multiflora*, *Roxb.*

An erect weed 6"-2 ft. high with numerous erecto-patent sharply 4-angled branches. Leaves linear or linear-oblong from a very broad sub-hastate or auricled base, larger sometimes 1-1.5". Flowers in compound peduncled cymes usually longer than the subtending leaves. Hyp. campanulate or tubular campanulate with 8 green ribs; longer than the 4 broadly triangular mucronulate sepals. Petals very minute red or O. St. 4, 6, or 8 with slender filaments exceeding the sepals. Fruit globose minute .05" diam.

Very common in wet places in all districts. Fl., Fr. r.s. and c.s. This is perhaps scarcely more than a finely branched variety of the last with smaller fruits but its appearance is different in the numerous slender cymes overtopping their leaves and becoming racemed.

6. *PUNICA*, *L.* Pomegranate.

1. *P. granatum*, *L.* Anar, *H.*; Dalim, *Beng.*

A large shrub or small tree with terete, or when young, 4-angled often thorny branches and opposite, sub-opp. or clustered oblong or obovate obtuse entire leaves with a distinct or obscure intramarginal nerve. Flowers large 1-5-nate terminating the shoots, with a thick fleshy, at first spherical, finally flask-shaped hypanthium produced considerably beyond the ovary and bearing above (in the neck) a thickened disc. Sepals 5-7 persistent. Petals 5-7 inserted between the sepals, obovate, imbricate in bud and crumpled. Stamens very many covering the whole of the disc, anthers versatile introrse. Ovary inferior adnate wholly or for the most part to the hypanthium, many-celled, the cells in 1-3 concentric more or less superposed whorls, style long, stigma capitate. Ovules very numerous anatropous, in some cells axile, in others parietal. Fruit a globose berry with coriaceous epicarp and crowned by the calyx, many-celled and -seeded. Seeds angular, cotyledons convolute.

Very commonly cultivated in gardens. In this province chiefly for its scarlet or orange-red flowers which are about 2" diam.

Fl. April-May. Fr. July-Sept.

The bark and rind of the fruit are used for tanning. The edible pulp is formed from the outer layers of the testa of the seed.

FAM. 67. ONAGRACEÆ.

Herbs, rarely undershrubs, sometimes aquatic. Leaves opposite or upper alternate, more rarely all alternate, simple (submersed leaves in *Trapa* are pinnatipartite), exstipulate. Flowers regular and typically 4-merous or sometimes sub-regular, often large or m.s. or showy, axillary, spiked or racemed. Hypanthium entirely enclosing the ovary (exc. in *Trapa*) with 2-5, usually 4 valvate sepals. Petals alternate with the sepals, rarely O. Stamens as many or twice as many as the sepals, epigynous, on the mouth of the hypanthium. Ovary adnate to the hypanthium 1-6-, usually 4-celled, style simple

with capitate or 2-4-lobed stigma. Ovules 1-many in each cell axile, pendulous or half-ascending. Fruit usually capsular, sometimes indehiscent, 1-many-seeded. Seeds with little or no albumen.

- I. Hypanthium more or less produced above the inferior ovary. Ovules and seeds many in each cell. Terrestrial or aquatic.
Fls. 4-6-merous, diplostemonous 1. *Jussiaea*.
Fls. 3-5-merous, isostemonous 2. *Ludwigia*.
- II. Hypanthium cupular calyciform only enclosing the lower part of the ovary, with no free tube above. Ovule 1 in each cell. Floating aquatic herb 3. *Trapa*.

N.B.—*Trapa* sometimes forms the type of a separate family, the Hydrocaryaceæ.

The Samydaceæ are in the *Genera Plantarum* placed after the Onagraceæ. The family has already been described with the Flacourtiaceæ.

1. JUSSIÆA, L. (*Jussieuia*, *Auct. plur.*)*

Herbs or undershrubs growing in wet places, sometimes floating with modified air-roots. Leaves alternate mostly entire. Fls. yellow or white, solitary axillary or sub-racemose. Hypanthium elongate but very slightly produced above the ovary with 4-6 acute persistent sepals. Petals white or yellow. Stamens twice the number of sepals, one whorl sometimes smaller, epigynous. Ovary 4-5-celled with very short style and 4-5-lobed stigma. Ovules many axile 1-several-seriate in each cell. Capsule linear 4-5-celled, 8-10-ribbed, opening from above septicidally, or the valves separating from the ribs or breaking irregularly between the ribs. Seeds many, sometimes dimorphous and enclosed in a corky fissile endocarp.

- A. Creeping or floating. Leaves obovate 1. *repens*.
- B. Erect. Leaves lanceolate acute.
Usually pubescent. Sep. broad. Seeds all similar 2. *suffruticosa*.
Glabrous. Sepals narrow. Lower seeds different from the upper and 1-seriate 3. *fissendocarpa*.

1. *J. repens*, L. Kasara-dam, Beng.

Creeping on the margins of tanks and with long stems floating out on the water by means of white air-roots, 5-1.5" long. Leaves obovate or oblanceolate 5-3" long narrowed into a long petiole. Flowers pretty, white, 1-1.5" diam. with the veins at the base of the petals yellowish. Petals 5-6 obovate, long- or short-peduncled. Capsule 5-1.5" rather woody. Seeds smooth reticulate 1-seriate each enclosed in a corky segment of the endocarp ("with a white corky testa" *Clarke*).

Common on tanks. Chota Nagpur! Santal Parganas! Purneah! Angul, Lacc! Fl., Fr. c.s.

2. *J. suffruticosa*, L. Dak'ichak', S.

An erect herb, scarcely an undershrub, suffruticose, 2-4 ft. high usually (always?) hairy and with decurrent raised lines. Leaves

* Since this sheet was sent to press *Ridley* has written a paper on "The Indo-Malayan Species of *Jussiaea*" in the *Journal of Botany*, September, 1921. He splits up *J. suffruticosa*, *nobis*, into *J. erecta*, L., and *J. villosa*, Lamk., and states that *J. fissendocarpa* is the real *J. suffruticosa* (though he does not give all the characters). And it difficult to determine from this paper whether one Angul specimen (collected by *Chattarjee* is *Ridley's J. erecta* var. *exaltata* or *J. villosa*, Lamk.

linear or lanceolate, rarely ovate-lanceolate, pubescent or hairy, subsessile or very shortly petioled. Hypanthium subsessile or tapering into a very short pedicel, pubescent, sepals ovate or broadly elliptic and acuminate, '2-3". Petals yellow '25-5" long. Capsule 1-2" tapering at base, pubescent (or finally glabrous, *teste Clarke*), thin, and breaking up between the ribs. Seeds rounded, brown or reddish, finally grooved.

Common in wet places, sides of tanks, etc., throughout the province! B., Fr. c.s. Raimann suggests that the seeds are each formed of two coalescent ovules of which one is barren.

3. *J. fissendocarpa*, Haines (*Journ. As. Soc. Beng.*, xv, 1919, No. 7).

A very tough much-branched undershrub 3-4 ft. high, stems glabrous with raised decurrent lines from the leaf-bases or sub-alate. Leaves lanceolate or linear lanceolate subsessile acute. Flowers sessile from all the upper axils. Sepals lanceolate '08-1". Petals shorter. Stamens with 4 smaller or absent. Hypanthium 4-ribbed. Capsule slender minutely pubescent '6-85" long terete 4-celled. Seeds in upper part of capsule minute ellipsoid sub-compressed, pale brown, '07 mm. with a prominent raphe (or white and half the size), several-seriate, in lower part of capsule 1-seriate, each enclosed in a 2-valved corky prismatic portion of the endocarp and larger.

Watery places, Purneah! Fl. Nov.-Dec. Fr. Dec.-Jan.

Upper leaves about 1" (the lower fallen in my specimens), not tapering to a slender base as in *Ludwigia parviflora* and *L. prostrata*, nearly glabrous. I have seen very few flowers and the size of the petals may vary.

2. LUDWIGIA, L.

Habit of *Jussieua* but perianth 3-5-merous, petals small inserted below the margin of the epigynous disc and stamens as many only. Ovules in two or more vertical rows in each cell. Capsule opening by terminal pores or breaking up irregularly along the sides. Seeds obovoid smooth.

Capsule inflated, seeds many-seriate in each cell 1. *parviflora*.
Capsule very slender. Seeds in one row in each cell 2. *prostrata*.

1. *L. parviflora*, Roxb.

A herb 8-18" high usually erect, glabrous, with lanceolate, linear-lanc. or linear-oblong leaves 1.5-3" long always tapering at the base into a short petiole. Fls. very shortly pedicelled small yellow usually 4-merous. Capsule very short oblong or linear-oblong '3-4" long, glabrous, seeds many-seriate not separately distinguishable through the capsule walls.

Gaya, near Grand Trunk Road! Chota Nagpur, Prain! Manbhum, common in ricefields, *Clarke*, *Milne*! *Kurz* says common in wet places in Western Bengal; his specimens are, however, small and diffuse.

Fl. Oct.-Nov. Fr. Nov.-Dec.

2. *L. prostrata*, Roxb.

Somewhat like the preceding but more diffuse prostrate or ascending with the lower branches longer than the stem spreading flat on the ground and rooting, generally reddish. Leaves thin glabrous lanceolate or ell.-lanceolate with very fine sec. n., narrowed

at base into a slender petiole. Sep. '07" narrow-lanceolate acute. Petals lanceolate longer than the calyx (*Roxb.*) yellow. Capsules much more slender than in last, '8", linear, often more or less curved, glabrous, obtusely 4-angled. Seeds minute pink 1-seriate, distinguishable through the capsule wall.

There are no specimens actually collected inside our area but it has been collected both sides, in the Gangetic plain and the Sikkim tarai. It will therefore almost certainly be found in the Northern Area.

"Roots often cellular and float-formed," *Keenan*.

3. TRAPA, L.

Aquatic herbs with the floating leaves rosulate, rhomboid, their petiole with a spongy dilatation, submersed leaves* in opposite pairs and cut into capillary segments. Flowers axillary solitary 4-merous with cupular hypanthium not produced above the ovary, sepals persistent, two or all spinescent in fruit. Sepals, petals and stamens in alternate whorls inserted on the margin of a perigynous disc. Ovary adnate below to the hypanthium, conical above, 2-celled with 1 ovule only in each cell pendulous from the inner angle. Fruit consisting of the lignified hypanthium, ovary and calyx together forming a 1-celled 2-4-horned indehiscent nut with a short often spinous beak through which the radicle issues. Cotyledons very unequal.

1. *T. bispinosa*, *Roxb.* Singhara, Pani-phal, *H.*; The Water Chestnut.

Floating leaves '8-2.5" diam, broader than long, denticulate, dentate, serrate or incised, with entire base, beneath red and densely pubescent or villous. Petiole 4-7" long, the inflated portion about 1" long, hairy or woolly. Fruit somewhat urn-shaped '9" long with the two horns forming the handles of the urn; the second pair of horns are usually wanting.

In tanks throughout the province! Fl. Aug. Fr. Nov.-Dec.

According to the *F.B.I.* the typical plant has leaves 2.5-3" wide, slightly crenate and very villous beneath, while var. *incisa* has leaves only about '75", inciso-serrate and much less villous. The common form in our area has the leaves about 2" diam. and coarsely toothed. Fls. white, '75" diam., not much raised above the surface of the water.

The kernel of the fruit is eaten.

FAM. 68. TURNERACEÆ.

A tropical American and African family of which we are only concerned with the following genus:—

1. TURNERA, L.

Shrubs or herbs with alternate simple leaves usually 2-glandular at the base with small or 0 stipules. Flowers regular 2-sexual axillary solitary, rarely fascicled or in racemes, yellow; peduncle sometimes adnate to the petiole, bracteoles 2 or 0. Hypanthium short usually swollen at the insertion of the stamens. Sepals 5. Petals 5, hypogynous, inserted at the base of the hypanthium. Stamens

* These organs are probably floating adventitious roots as described in *Nat. Flaus. Fam.* They arise below the axils of fallen leaves.

5, more or less perigynous and often connate at base, anthers oblong with longitudinal dehiscence. Ovary free 1-celled with 3 parietal placentæ and 3 styles simple or with flabellately divided stigmas. Ovules numerous anatropous, 2-seriate on the placentæ. Fruit a 3-valved capsule bearing the seeds in the middle of the valves (as in Samydaceæ or Flacourtiaceæ to which the family is closely allied). Seeds oblong curved with a membranous aril, fleshy albumen and terete embryo.

1. *T. ulmifolia*, L. Basanti, Vern.

Herb or undershrub with densely hairy shoots broad- or narrow-lanceolate or elliptic-lanceolate coarsely serrate leaves 3-4" long with 2 large glands at the end of the 5-1"-long petiole. Fls. yellow 1.5-2" diam. with the peduncle adnate to the petiole and bearing a pair of leaves below the flower (bracts?). Hypanthium funnel-shaped hairy with lanceolate sepals 3-4" long. Capsule sub-globose oblong 3" hairy and minutely tubercled, sometimes only 2-valved, with elliptic-oblong brown rugose seeds.

Bettiah, Rastler! Roadsides, Orissa! Fl., Fr. c.s. Introduced from America.

FAM. 69. PASSIFLORACEÆ.

Herbs or shrubs climbing by means of tendrils, very seldom twining, with alternate stipulate simple and palmi-nerved or usually palmately-lobed, rarely penni-nerved leaves frequently with glands on the undersurface or petiole. Flowers axillary cymose rarely solitary regular 1-2-sexual and sometimes dimorphous. Hypanthium usually well-developed, mostly tubular or campanulate with 3-5 sepals. Petals usually present and free, sometimes connate, alternating with the sepals imbricate in bud, marcescent. A 1-many seriate "corona" of filamentous or other formed scales usually clothes the intrastaminal zone of the hypanthium. Stamens 5 usually on a gonophore, sometimes inserted inside a semi-perigynous disc, anthers oblong, introrse. Ovary usually on the gonophore but sometimes sub-sessile, 1-celled with 3 rarely 4 parietal placentæ and 1-3 styles with more or less capitate stigmas. Ovules numerous on the placentæ 2-many-seriate anatropous. Fruit a berry or capsule. Seeds usually many with a fleshy aril and albumen, cotyledons foliaceous.

1. *PASSIFLORA*, L. Passion-flower.

Flowers 2-sexual with well-developed hypanthium. Sepals often coloured within. Petals free. Stamens on a long gonophore with the ovary. Coronal filaments very numerous. Ovary with 3 placentæ and more or less distinct styles. Fruit baccate.

A large American genus with few representatives elsewhere. Some species are common in gardens.

1. *P. foetida*, L.

A slender foetid-smelling climber with palmately-3-lobed leaves 1.5-2.5" long, ciliate and denticulate with gland-tipped setaceous



71. CUCURBITACEÆ.

hairs, similar hairs also beneath and simple hairs above, stipules lacinate with gland-tipped segments. Flowers 1", greenish, mostly solitary axillary, with an involucre of finely pinnatifid bracteoles with capillary glandular segments. Fruit like a small green gooseberry.

Widely distributed, in most districts! Fl., Fr. r.s. and c.s.

FAM. 70. CARICACEÆ.

Small trees, often with an unbranched crown of long petioled alternate palmi-lobed leaves and with milky juice. Flowers monœcious or usually diœcious, the females shortly cymose, solitary, or fascicled axillary, the males smaller in axillary panicles, 5-merous. Calyx short. Corolla of male gamopetalous, of female much larger poly-petalous. Stamens in the male 10 in two whorls in the corollatube. Female with staminodes. Ovary 1- or 5-celled with short style and 3-5 palmately-branched lobes. Hermaphrodite flowers occasionally occur in three forms, either the stamens are only 5 hypogynous in an otherwise nearly normal female flower, or the stamens are 10 perigynous inserted high up in a tube adnate to the corolla, or the stamens are 10 epigynous closely adnate to the ovary with their bases connected by a ridge. Ovules very numerous parietal. Fruit a large 1-celled or 5-celled berry. Seeds many with an outer sappy and an inner hard testa, albuminous.

1. CARICA, L.

1. *C. papaya*, L. Papaya, Papita, Vern.; The Papaw.

A well-known small tree with very large palmately lobed leaves, the lobes again variously lobed. Sepals and petals in alternating whorls. Flowers greenish-white or white, females large subsolitary or in very short cymes, males paniced. The different 2-sexual forms referred to above all occur in this species in India, always (where I have seen them) on a male inflorescence. Fruit 1-celled.

Fl., Fr. end of r.s. and beginning of the c.s. The digestive ferment Papain is extracted from the milky sap.

FAM. 71. CUCURBITACEÆ.

Herbaceous, more rarely shrubby, climbing by means of tendrils. Leaves alternate simple palmately lobed or pedately divided, rarely pinnately lobed, venation palmate or pedate. Flowers small to very large, solitary axillary clustered cymose or racemose, monœcious or diœcious. Calyx and corolla inserted on a variously shaped often elongate hypanthium which is constricted above the ovary.* Corolla poly- or gamo-petalous. Stamens inserted at various levels on the

* In referring to the shape of the hypanthium in the generic and specific diagnosis the male hypanthium and the female part of the hypanthium above the ovary is alluded to. As the wall of the hypanthium forms also the ovary wall the shape of the ovary is sufficiently explicit for the lower part.

hypanthium, normally 5 with extrorse anthers each with one anther-cell, but usually connate in pairs so that only one remains free (in which case there appear to be two stamens with 2-celled anthers and one with 1-celled anther and are *shortly described* as "three stamens"), anthers often connate and their cells straight or variously curved or twisted. Ovary usually 1-celled, the three parietal placentæ often however meeting and filling up the ovarian cavity, or ultimately 3-celled. Ovules anatropous usually numerous. Style stout with 3-5 stigmas. Fruit a berry, entirely succulent or finally with a hard rind (when it is called a pepo), rarely entirely dry. Seeds with a hard testa, exalbuminous with straight embryo.

The morphology of the tendril has been investigated by several authors. It is apparently a shoot or partly a shoot and partly petiolar and foliar. The axil of the leaf often contains a peculiar stipule-like bract, described as a solitary stipule by *Roxburgh* in the case of some species. This member has scarcely been noticed in any other work I have seen. It would also appear to be the first leaf of a suppressed axillary shoot. It is very noticeable in species of *Luffa*, *Cucurbita*, etc.

In all the genera examined by me with the compound microscope, viz. *Trichosanthes*, *Luffa*, *Momordica*, *Bryonia*, *Cucurbita* and *Cephalandra*, the ovary is initially 1-celled with parietal placentæ. In some cases the apparent septa is an exceedingly small-celled tissue or mucilage formed subsequently to the meeting of the enlarged placentæ with which the ovarian cavity becomes filled and the tissue of which is plentifully supplied with spiral vessels. In *Luffa* the septa are the ingrown placentæ. Germination is epigeal, the cotyledons sometimes attaining very large dimensions.

The following species all belong to the tribe Cucumerinæ in which the ovules are mostly horizontal, leaves not compound, female flowers usually solitary.

I. Petals free or corolla deeply 5-partite.

A. Flowers white (or greenish in *Melothria*, sp.).

- | | |
|--|---------------------------|
| 1. Anther-cells conduplicate or sigmoid. | |
| a. Fls. large, solitary. Hypanthium funnel-shaped* | 1. <i>Lagenaria</i> . |
| b. Fls. large or m.s. Hyp. tubular elongate. | |
| Petals fimbriate. Tendrils 2-5-fid. | 2. <i>Trichosanthes</i> . |
| Petals entire or toothed. Tendrils 1-2-fid† | 3. <i>Gymnopetalum</i> . |
| 2. Anther-cells straight or curved. | |
| Flowers small. Hypanthium campanulate | 4. <i>Melothria</i> . |

B. Flowers yellow.

- | | |
|---|--------------------------|
| 1. Fls. small, solitary or clustered. Anthers 3 free. | |
| Anther-cells straight, connective mucous | 5. <i>Mukia</i> . |
| Anther-cells curved or sigmoid | 6. <i>Bryanopsis</i> . |
| 2. Fls. m.s., solitary or clustered. Anthers cohering, cells horse-shoe shaped or conduplicate. | |
| a. Peduncles not bracteate. | |
| Connective crested. Tendrils simple | 7. <i>Cucumis</i> . |
| Connective mucous. Tendrils 1-3-fid† | 8. <i>Citrullus</i> . |
| b. Peduncles (or those of male) slender with a large median or apical bract. Tendrils simple | 9. <i>Momordica</i> . |
| 3. Flowers large, solitary. Stamens inserted near mouth of hypanthium, anther-cells sigmoid | 10. <i>Benincasa</i> . |
| 4. Fls. large, male-peduncles often paired, one with racemed fls. (exc. <i>Luffa</i> , sp.). Stamens often 5. | |
| Stamens 3-5. Anther-cells sigmoid | 11. <i>Luffa</i> . |
| Stamens 6. Anther-cells straight | 12. <i>Thladiantha</i> . |

II. Corolla distinctly gamopetalous with tube exceeding the lobes.

- | | |
|--|--------------------------|
| Flowers yellow, very large. Tendrils 2-4 fid | 13. <i>Cucurbita</i> . |
| Flowers white, m.s. Tendrils simple | 14. <i>Cephalandra</i> . |

* In the female the shape of the hypanthium above the ovary is alluded to.

† 1-2-fid means *simple* to 2-fid.

71. CUCURBITACEÆ. [2. TRICHOSANTHES.

1. LAGENARIA, Seringe.

Large herbaceous climbers, pubescent, with 2-fid tendrils, ovate or orbicular cordate and dentate leaves and long petiole with 2 glands at the apex. Flowers large white solitary monœcious or dioecious, M. long- F. short-peduncled. M. hypanthium funnel-shaped sub-campanulate with 5 narrow sepals, petals 5 free obovate, stamens (apparently) 3 with connate included anthers and conduplicate anther-cells. Pistillode 0. F. perianth as in male, ovary oblong, with short style and 3 2-fid stigmas. Fruit large indehiscent polymorphous. Seeds compressed smooth with a marginal groove.

1. **L. vulgaris**, Ser. Syn. *Cucurbita lagenaria*, L.; Lauki, Kadu, H.; Lau, Ladu, Beng.; Loewa, Uran; Suku, K.; Bottle-gourd.

A coarse glandular and softly hairy usually monœcious plant with hairy leaves 7-8" diam., 2-glandular at the base, and large solitary white flowers 3-4" diam. Male peduncle 5-6", hyp. 5-75", sepals 3-4", petals often 2" by 1" ovate with excurrent mid-rib. Fem. sepals 25" linear, hyp. tube above the ovary very short, hypanthium and young fruit villous or hairy.

Cultivated in all districts. Fl. July-Jan. Fr. c.s.

The unripe fruit contains a thick white pulp which in the cultivated plant is sweet and edible. The ripe fruit is variously-shaped with a very hard shell; a common form is dumb-bell-shaped used for bottles (tumba, K.), musical instruments, etc.

2. TRICHOSANTHES, L.

Herbaceous or suffruticose with 2-5-fid tendrils and white flowers, males in long racemes (exc. *dioica*) with a solitary female or male at the base from the same axil, or females separate. Hypanthium elongate tubular or wider above and dilated above the ovary. Corolla rotate with nearly free fimbriate petals. Filaments 3, anthers connate (free in *dioica*). Fruit ellipsoid to elongate or globose, smooth. Seeds many compressed, usually margined.

Perennial. Bracts large sheathing 1. *palmata*.

Annual or perennial. Bracts very small or 0.

Longer male peduncle with a raceme of flowers 2. *cucumerina*.

Both male peduncles with single flowers St. free 3. *dioica*.

1. **T. palmata**, Roeb. Kaubutki, K.; Makal, H., Beng.; Jar Mahwrar, Kharu.; Ma Kirla, Or.

Trailing on bushes or climbing on high trees with a suffruticose stem and long pendent branches, 2-5-fid tendrils, and rather large simple or lobed cordate and denticulate leaves attaining 6" by 5". Flowers white 2.5-3" diam., bracts on the raceme broadly obovate foliaceous and over 5" long with large deep green circular glands and sharply dentate. Fruit bright scarlet globose or usually ellipsoid 2-2.5" by 2" on axillary short stout peduncles.

Widely distributed but nowhere very common. Parneah, common! S.P.! Ranchi, Palaman and Singbhum in Chota Nagpur, in valleys and on the plateaux! Angul! Fl. Aug.-Sept. Fr. Nov.-Dec., rarely to Jan. Perennial.

Large green glands sometimes near base of leaf. Always some leaves lobed on large plants, lobes mostly 5 broadly or narrowly lanceolate with the nerve slightly excurrent, in one variety incised and sub-spinulose, upper surface smooth and bright green with small pits when fresh but very scabrous with small round discs

TRICHOSANTHES.] 71. CUCURBITACEÆ.

(cystoliths) when dry, lower surface paler with cystoliths on the nerves when dry, primary nerves 3-5 (or 7, lowest forked near base). Petiole 1-2". Some specimens have the nerves slightly scabrid-hairy beneath, others glabrous but with more marked cystoliths, but the former are in flower and the latter in fruit and it may be a matter of age. Flowers dioecious (or sometimes monoecious?). Male peduncles usually paired, the racemed one 3-4". Calyx-tube 1.5-2.5" long. Rind of fruit .25" thick when fresh. Seeds embedded in dark-green pulp, oblong, flattened, slightly narrowed at base, .4-.5" long.

The fruit and root boiled with mustard oil is used for headache. The root is said to be poison and applied for snake-bite.

2. *T. cucumerina*, L., inc. *T. anguina*, L. (see variety). Bir Kaita, K.; Ban potol, Beng.

A slender rather succulent climber with long-petioled deeply cordate 5-7-angular or -lobed and dentate leaves 3-4" diam. rarely 5". White flowers .75-1.2" diam. with fimbriate petals and spindle-shaped rostrate fruits 1-3" long at first green with white stripes, ultimately red.

Frequent in Chota Nagpur! Behar, Hope! Probably in all districts. Fl. Aug.-Dec. Fr. Sept.-Jan. It is always described as annual, but this is not always the case. Not only is the rootstock sometimes stout but I have found the remains of a previous crop of fruit on a new flowering plant.

Stems often angled and .25" diam. L. mostly sub-orbicular, smooth to touch, basal sinus very marked, either rectangular or almost enclosed by the basal lobes, margin denticulate from the mucronate nerve endings. Primary nerves closely shortly pubescent or somewhat scabrous beneath, above puberulous, petiole 1-1.5". Tendrils 3-fid. Monoecious. Male and female from the same axil. Male raceme 2.5-3" or 5-8" long. Fem. solitary shortly stalked. Hypanthium .25-.75".

Var. *anguina*. Syn. *T. anguina*, L.; Kaita, K.; Chachinda, H.; The Snake Gourd.

This is the cultivated form. Leaves 4-6" or up to 11" diam., sometimes very deeply lobed with narrow sinuses except the basal one which is very broad. Fls. 1.5-2". Fruit very long, attaining 2 ft. and often spiral, green with white stripes when young.

Very commonly cultivated. There are all gradations between this and the wild form. *Chachinda* is usually served up in the shape of French beans, long narrow strips of very light vivid green but no flavour.

3. *T. dioica*, Roxb. Potol, Beng.; Palwal, H.

A climber with rather slender angled stems hispid and with soft hairs, ovate cordate leaves 2-4" with a deep sinus, margins denticulate and occasionally lobulate, petiole .5-1.5" hispid and hairy or almost woolly. Fls. all axillary, M. often paired, one short- the other long-peduncled, hyp. slender 1.2-1.5" long, villous or woolly. F. short-peduncled 1.5", a glandular bract at base of peduncle. Sep. oblong-lanc. .2". Fruit 2-3.5" or (in cultivation) 4", oblong. orange. Seeds .3-.5", little-compressed with a slightly corrugate margin.

Rare in a wild state. Darbhanga, Prain's Collector! Fl., Fr. r.s. L. scabrous with cystoliths when dry, basal lobes rarely somewhat hastate. Tendrils usually forked. Peduncle of long-peduncled male slender, often 2" long. Pet. .5" with long fringes. Stamens 3 distinct.

The unripe fruit cooked forms a commonly eaten vegetable. Roxburgh says that it is reckoned extremely wholesome. The tender tops are also used as a pot-herb and are regarded as tonic and vermifuge. The tender shoots and dried fruits are very bitter and aperient and given in decoction to assist digestion. Seeds anthelmintic (*Nadkarni*).

3. GYMNOPTALUM, Arn.

Leaves as in *Trichosanthes*. Tendrils simple. Fls. white or yellow, as in *Trichosanthes* but F. also sometimes racemed like the male, hypanthium sometimes curved, sepals linear or subulate, petals entire or toothed but not fimbriate. Fruit often ribbed when young. Seeds compressed marginate in a blackish-green pulp.

1. *G. cochinchinense*, Kurz. Kaubutkila, K.

A pretty climber with bright-green foliage and white flowers 2" diam. M. solitary and racemed from the same axil. F. solitary or occasionally also racemed. Corolla-lobes oblong toothed or entire. Fr. 2" by 1.25" bright orange-scarlet, ovoid-oblong, with 10 strong ribs when young.

Ranchi and Singbhum, on the ghats and plateaux. Fl. Aug.-Oct. Fr. Sept.-Nov.

Stems sparsely pubescent or hispid. L. lower deeply cordate orbicular, 5-7-lobed and denticulate 2-4", scabrous above, hispidulous beneath, basal lobes rounded and sinus wide, other lobes acute or acuminate. Raceme 5-9" with foliaceous bracts 5", obovate-cuneate, palmatisect. Hypanthium curved pubescent 1", sepals 25". Anthers connate. Fem. hyp. 5-6" above produced as a calyx-tube 5-6" above the pubescent ovary, which is 10-ribbed. Seeds brown, somewhat compressed, 3" by 12".

4. MELOTHRIA, L. (inc. Zehneria).

Usually slender herbs with simple tendrils and entire to deeply-lobed leaves. Fls. small white greenish or yellowish-white, monœcious or diœcious, pedicelled corymbose or racemose or clustered on the rhachis of a raceme, very rarely in axillary clusters, female solitary, fascicled or umbelled. Hypanthium tubular-campanulate or broadly campanulate with minute sepals. Corolla deeply 5-partite. Stamens 3 inserted about or below the middle of the hypanthium, anthers free or slightly cohering with anther-cells straight, flexuose or sigmoid, connective mucicose or papillose at the top or produced beyond the cells, staminodes sometimes present in female. Hypanthium much constricted above the ovary which is oblong or fusiform, more rarely globose, with 3 placenta and numerous ovules. Disc present annular at base of the short style. Stigmas 3, rarely 2. Pistillode present in male. Fruit baccate with usually many ovoid or oblong-rounded or compressed, smooth tubercular or pitted seeds, sometimes obscurely margined.

The F.B.I. keeps *Zehneria* separate from *Melothria*. Cogniaux unites these two genera as well as *Makia*. The last differs in its pronounced yellow flowers always clustered axillary short-pedicelled or sub-sessile and small, round, never fusiform fruit.

L. polymorphous. M. fls. corymbose. Petals triangular 1. *heterophylla*.
L. 3-lobed. M. fls. clustered on the angles of racemes. Petals ovate 2. *zehnerioides*.

1. *M. heterophylla*, Cogn. Syn. *Zehneria umbellata*, Thw.; Ban Kundri, H., Beng.; Chengor, K.; At', S.; Karakia, Matka, Makirla, Or.; Tura, Gond.

A prostrate or climbing plant with angled smooth stems from a tuberous root (a chain of fusiform tubers in old plants), polymorphous

[MELOTHRIA.]

71. CUCURBITACEÆ.

leaves usually 5-nerved and pale beneath, always cordate, hastate, or sagittate at the base, denticulate, rarely exceeding 6" in length and always with a very short sometimes pubescent petiole '25-'75" long; glabrous or hispid above. Hypanthium greenish, petals small triangular white. Male flowers articulate '2" on slender pedicels '17" long in peduncled corymbose racemes under 1.5" long, and usually with a solitary short-peduncled female from the same axil; connective papillose on the top, pistillode 3-lobed, pedicels with a fusiform bract from near the middle. Ovary narrow. Fruit ellipsoid 1-1.6" long scarlet with red pulp and 12-20 smooth ellipsoid slightly compressed white seeds, sometimes with a slightly corrugate margin. Fruiting peduncle '3-'6" stout.

Throughout the province inside the forests and especially in rocky ravines (probably on account of the pigs being unable to get at the tubers). Fl. April-Oct. Fr. May-Jan. Dies down at the end of the c.s. and puts out new shoots in the hot season.

Every part of the plant is eaten, including the leaves and ripe fruits. The following forms occur:

- I. Leaves not, or only slightly, lobed with rounded lobes, ovate cordate.
 - a. L. small 1-2.5" with minute pits above when green (as in most of the forms) showing as small raised discs (cystoliths) when dry. Puri!
 - b. L. 2.5-5.5" glaucous. Puri! Angul! Mayurbhanj, *Burkill*! Chota Nagpur!
 - c. Leaves up to 7" with 5-nerved base but only 2-3 sec. n. It is called Ma-kirla in Angul from confusion with *Trichosanthes palmata*, from which it may be distinguished in leaf by its weak habit. L. only denticulate, neither rugose nor with impressed nerves above nor hispid on the nerves beneath, also by its short petiole.
 - d. Like (c) but more lobed and sinuate, called "Matka" in Angul, never dentate or serrate as in *Trichosanthes*.
- II. Leaves hastately or sagittately lobed.
 - a. Lobes sub-equal. Burdwan, *Clarke*! Mayurbhanj!
 - b. Mid-lobe very much larger than the side lobes.
 - i. Leaves under 3". Puri!
 - ii. Leaves up to 6" long or more, cystoliths less evident. Purneah! Chota Nagpur!
- III. Leaves deeply 3-5-palmatifid with all lobes narrow and usually small. Puri!

NOTE.—*Clarke* (*F.B.I.*, ii, p. 625) says that the seeds are sometimes only 4-6 but he includes *Bryonia amplexicaulis*, Lamk. He also notes that the bracts on the pedicels are sometimes absent. They appear to me always to occur on some of the pedicels and in young stages of the inflorescence. They are very curious structures, being often inflated! The female flower is often solitary in the axils of leafy bracts of lateral branchlets with a similar inflated bract in the same axil.

2. *M. zehneroides*, Haines. *Journ. Asiatic Soc.*, xv, No. 7, 1919.

A slender climber with striate sparsely hispid stems, 3 (-5)-lobed leaves 2.5-3" long scabrid on the margins and nerves and with very scabrid petiole '3-'5". Fls. small white clustered at the angles of short racemes, ♂ and ♀ mixed, campanulate with linear-subulate sepals. Anthers all 2-celled with nearly straight cells and connective neither swollen nor produced. Fruit '3-'4" sub-globose or somewhat ellipsoid on slender peduncles with flat elliptic-obovate white seeds '13" long.

Purneah! Fl. Fr. Dec. [But all the mature male flowers fungus-infested in my specimens and buds only available.]

Leaves with lanceolate or oblong or linear oblong lobes, the basal sometimes with a subsidiary lobe very like forms of *Zehneria umbellata* but easily distinguished by the hispid nerves and a few long hairs at the top of the petiole insertion. Racemes zigzag 1-2.5" long, pedicels '2-'3" scabrid. Fem. fl. '3", hypanthium white broadly campanulate, sepals small linear, corolla rotate with broadly ovate acute papillose petals.

5. MUKIA, Arn.

Scabrous herbs with simple tendrils and 3-7-angular not deeply-lobed cordate leaves, often sub-sessile. Fls. small yellow, M. and F. clustered in the same axil; males very shortly peduncled and F. subsessile. Hyp. campanulate, sepals very small subulate, corolla 5-partite. St. 3 inserted low down, anthers free with straight cells. Ovary ovoid with thick style 2-3-lobed. Placentæ 2-3, ovules not very many. Berry small globose. Seeds ovoid compressed strongly margined, faces rough or smooth.

1. **M. maderaspatana**, Kurz. Syn. *M. scabrella*, Arn.; *Cucumis maderaspatanus*, L.; *Melothria maderaspatana*, Cogn.; Bilari, H.

A very scabrous small climber with firm 3-7-lobed and toothed very rough deeply cordate leaves attaining 4" by 3.5", usually much smaller. Petiole of upper leaves sometimes 0, of lower sometimes attaining 2". Flowers 12-17" diam. Berries scarlet with firm epicarp 3-4", often hairy.

Common, climbing over bushes in low jungle and open places. Fl., Fr. Sept.-Dec. Very pretty when in fruit with its clusters of scarlet berries.

6. BRYONOPSIS, Arn.

Climbing with 2-fid tendrils. Leaves palmately or sub-pedately 3-7-lobed. Flowers small yellowish, M. and F. clustered in the same axils. Hyp. (i. e. above the ovary in F.) widely campanulate with minute sepals. Corolla 5-partite. Stamens 3 inserted low down, anthers free with curved or sigmoid cells, connective muticous. Pistillode 0. Ovary ovoid with slender 3-fid style, disc 0. Placentæ 3. Berry globose. Seeds not very many, oblong or ovoid compressed with a corrugate vertical band (in our species).

1. **B. laciniosa**, L. Syn. *Bryonopsis laciniosa*, Naud.; Kahubotke, S.; Pachguria, Kharw.; Mala, Beng.

A climbing foetid herb with cordate usually deeply 2-7-lobed or -partite leaves 2-4". Petiole 1-1.5". Flowers small yellowish, males with slender 5-1" pedicels, females shorter. Fruit smooth globose 5-6" diam. green or when quite ripe red, with white stripes. Seeds in a blue-green pulp, pear-shaped.

Common in hedges. Purneah! Throughout Chota Nagpur! Angul! Fl., Fr. April-Dec.

Stems nearly smooth. Leaves sometimes only 3-lobed and less than half-way down but usually 5-lobed beyond the middle and with two subsidiary basal pedate lobes, orbicular-ovate, three central lobes usually lanceolate and narrowed at their bases, slightly scabrid above, almost smooth beneath, margin minutely denticulate, cystolithic dots above when dry but not very conspicuous. Flowers sometimes in much abbreviated racemes. Petals 2" light-yellow.

The fruit is eaten readily by horses and cattle.

7. CUCUMIS, L.

Hispid or scabrid herbs with simple tendrils and monœcious flowers. Males fascioled or sub-solitary, females solitary, axillary short-peduncled. Hypanthium short. Corolla deeply divided. Stamens 2, anther-cells conduplicate or only flexuose. Connective produced

into a crest above the anther. Ovary sometimes apparently 3-septate, style short, stigmas 3, obtuse. Fruit fleshy. Seeds oblong compressed mostly smooth.

- A. Leaves scabrid. Fruit quite smooth.
 L. palmately 3-5-lobed beyond the middle. Fr. oval . . . 1. *trigonus*.
 L. scarcely lobed. Fr. roundish . . . 2. *melo*.
 B. Leaves membranous hairy. Fr. hispid or muricate . . . 3. *sativus*.

1. **C. trigonus, Roxb.** Bing Dimbu, K.

A procumbent and trailing plant, scarcely ever climbing, with scabrous stems and petioles and small deeply palmately 3-5-lobed harsh leaves 1-2.5" diam., scabrous on both sides and with the lobes dilated at the tips or again sub-lobed. Fls. yellow .5" diam. Fruit usually ellipsoid, rarely ovoid-globose, 1.25-1.5" diam. striped green and white or green and paler green, quite smooth, finally yellowish.

Very common on open dry ground. Fl., Fr. Aug.-Oct.

The root is said to be perennial and according to *Naudin* it is by this character alone that the species can properly be distinguished from the next. It is very probably the wild form or one of the wild forms of the cultivated Melon. Petiole .5-1.5". Male fls. sometimes solitary. Hypanthium densely hairy or villous, .25", with very small sepals, corolla .5" diam., hispid-hairy without. Pedicels .3".

2. **C. melo, L.** Kakri (the vegetable), H.; Karbuz (the fruit); Melon.

The above names refer to the cultivated plant. The wild form is called Bing Dimbu by the Kols. This is a procumbent annual plant sometimes with the stem rather thickened towards the base, the whole plant scabrid and hispid but the hispid hairs are often deciduous above the base, especially on the leaf surfaces between the nerves, thus leaving it nearly scabrous. Leaves orbicular or ovate with shallow rounded or sub-angular lobes or sub-entire, denticulate with mucronate nerve-endings, texture thinner than in the last species, 1.5-2.5" diam., basal sinus often very shallow, petiole 1.5-3", tendrils often long which it uses chiefly for climbing among grass only. Male flowers usually 5-6 axillary with peduncles about .25". Hypanthium .25" campanulate villous, sepals distant linear-subulate very small. Corolla .5-1.25" diam. divided beyond the middle, lobes obtuse pubescent. Fem. solitary, much as in the male. Fruit spherical usually striped as in the last.

Common in waste ground in Chota Nagpur and probably in other districts! Fl., Fr. r.s.

The cultivated Melon only differs by the larger size of all its parts and perhaps by the somewhat softer indumentum. *Prain* says it has both soft and harsh hairs. The fruit of the wild plant ultimately turns yellow, and is conspicuous lying on the ground attached to the plant long after the death of the vegetative parts, which are distinctly annual.

3. **C. sativus, L.** Khira, H.; Kaknai, Or.; Cucumber.

A hispidly hairy climber with membranous deeply cordate angled or shallowly 3-5-lobed leaves about 4.5" diam., the larger up to 6" by 5.5", both sides hairy with softish hairs but the upper with thickened bases and the ribs beneath scabrid or hispid, margin denticulate, terminal lobe sometimes lanceolate and basal lobes sometimes sub-hastate. Petiole 2-4". Flowers yellow .7-1" diam. Males clustered,

Hyp. tubular or campanulate with long white hairs .25-.3", sepals linear spreading .15-.2", fil. very short, anthers cohering with connective crested or clavate above the cells. Female solitary, hypanthium .15" more urceolate with oblanceolate sepals .2", thickly covered with very bulbous-based hairs or soft spines ending in a deciduous hair so that the fruit is covered with harsh hairs or soft spines and finally more or less muricate, cylindric.

Apparently wild in several places in Chota Nagpur in open and scrubby jungles! and in the Porahat Forests (e.g. between Nakti and Tebu)! Fl. r.s. Fr. up to Oct.

The cultivated plant is the well-known Cucumber and the above-described forms are probably feral. *De Candolle* surmised that the wild plant is indigenous in India in the region of Afghanistan.

The flattened and elliptic seeds, like those of *C. melo*, yield a sweet edible oil which is nutritive and diuretic. The pulp of the fruit is also diuretic and beneficial in eczema (*Nadkarni*).

8. CITRULLUS, Neck.

Usually prostrate and trailing hispid or scabrous herbs with simple or 2-3-fid tendrils and palmately or pinnatifidly lobed leaves often with sub-pinnatifid segments. Flowers monœcious, solitary, rarely geminate, yellow, not very large with short campanulate hypanthium. Corolla rotate, deeply lobed. Stamens 3, anthers scarcely cohering, connective not produced, cells conduplicate or sigmoid. Ovary with 3 placenta, short style and 3 reniform stigmas. Fruit at first very fleshy, globose or ellipsoid, smooth, indehiscent. Seeds very many oblong compressed smooth.

Leaves 2-4.5", pale, with the close scabrous cystoliths 1. *colocynthis*.
Leaves 3-8", thin, sparsely scabrid. Cultivated 2. *vulgaris*.

1. *C. colocynthis*, Schrad. Indrayan, H.; Colocynth or Bitter Apple.

Rather a pretty prostrate very scabrous grey coloured herb with usually simple tendrils ovate or lanceolate or lanceolate-oblong leaves pinnatifidly lobed, the lowest lobes palmatifid opposite, segments again pinnatifid, lobed or lobulate, closely covered with small round discs when dry and nerves hispid. Fls. .5-.7" diam. Fr. globose 1-3" diam. smooth variegated green and white on a hispid and hairy peduncle. Seeds .2-.25" by .15".

Said to be generally cultivated, but I have not seen it so in our province. My specimens were collected in the Central Provinces and were apparently wild. Fl. Nov. Fr. Jan.

The fruit is bitter, acrid and cathartic and finds a place in the *British Pharmacopœia*. It is poisonous in large doses.

2. *C. vulgaris*, Schrad. Syn. *Cucurbita citrullus*, L. (also in *F.I.*); Tarboj, K.; Tarbuz, H.; The Water Melon.

Prostrate with pubescent or hairy or nearly glabrous stems and 2-3-fid tendrils. Leaves 3-5-partite with the segments pinnatifid or lobed, sometimes linear, denticulate or margin nearly smooth, usually about 6" by 5", dotted beneath and somewhat scabrid with hispid or hairy nerves. Fls. solitary or paired on long peduncles 1-2". Hypanthium short campanulate with linear sepals .25" long. Corolla silver-shaped 1" diam. lobed nearly to base, petals 3-5-nerved,

somewhat puberulous. Stamens distinct, anthers sigmoid. The second flower in the axil is often abortive. Fruit 4-10" diam.

Largely cultivated, especially on the sides of rivers. Annual. Native of Tropical Africa, and *De Candolle* relates that both sweet and bitter fruits are found in the wild state. Fl., Fr. h.s.

The axil of the leaf often contains a peculiar obovate stipule-like bract '75" long, 3-nerved and foliaceous, which is probably the leaf of a suppressed axillary shoot. It would be described by *Roxburgh* (but he gives no detailed description of this species) as a stipule and corresponds to his "solitary axillary cordate stipule" in *Luffa pentandra*.

9. MOMORDICA, L.

Tendrils simple. L. undivided or palmatisect. Fls. monœcious or diœcious, solitary peduncle often with a large bract. Hyp. campanulate. Corolla nearly polypetalous. Filaments 3, anthers with horse-shoe-shaped or conduplicate cells. Style long, stigmas 3. Fruit indehiscent or sometimes 3-valved, muricate echinate or smooth. Seeds obovate or oval sometimes rectangular often corrugate on the margin and sometimes on the faces.

In a species outside our area the M. peduncles are 2-5-fld. and the stamens are two only.

Fls. monœcious. L. very deeply 5-7-lobed. Fr. tubercled	1. <i>charantia</i> .
Fls. diœcious. L. entire or slightly lobed. Fr. echinate with soft spines	2. <i>dioica</i> .

1. *M. charantia*, L., inc. *M. muricata* (F.I.); Karela, H.; Kirla, K.; Karena, Or.; Karala, uchchhe, Beng.

A softly-hairy rather slender climber with pedately 5-7-fld or -sect leaves 1-4.5" diam., the segments again lobulate or sinuate and denticulate, the teeth usually ending in a fine point. Fls. yellow .5-6" diam., males on filiform peduncles often 3.5" long with one orbicular foliaceous bract near the middle, female peduncle nearly as long, bracteate near the base. Petals sometimes distinct to base, obovate, spreading. Fruit ovoid or fusiform, tapering both ends, ribbed and covered with tubercles, 2-3" long, yellow when ripe, beaked. Seeds compressed with corrugate margins.

Very common in hedges and widely cultivated. Often found wild in waste places. Fl. Aug.-Jan. Fr. Aug.-Feb.

The fruit is bitter, but wholesome and eaten as a vegetable. It is said to be tonic and stomachic and useful in gout and rheumatism. It is also anthelmintic (*Nadkarni*).

2. *M. dioica*, Roxb. Ochen, K.; Kaksa, H.; Ban-Karela, Beng.; Kanchan-arak', S. (the fruit "Karla").

A slender nearly glabrous climber with foetid smell, angular stem, deeply cordate simple or 3-lobed often sinuately denticulate ovate leaves 2-4.5" and solitary axillary yellow diœcious flowers with petals .7-1" long, M. on slender peduncles 2-6" easily recognised by the persistent spathaceous deeply concave orbicular bracts wrapping round the buds and enclosing base of the flowers. F. peduncles usually somewhat shorter or as long as the male with a small bract somewhere near the middle, ovary densely hirsute-fimbriate, the fimbriæ in fruit bearing soft fleshy spines which are lanceolate to ovate when dried.

71. CUCURBITACEÆ.

[11. LUFFA.

Common in hedges throughout the province and apparently wild. Fl. Aug.-Sept. Fr. Sept.-Oct.

Root perennial, tuberous. L. punctate beneath and dots sub-translucent when fresh (appearing as white dots above when dry), basal auricles sometimes very large and meeting round the sinus. M. fl. calyx campanulate '4" long with oblong-lanceolate or linear sepals as long as tube. F. fl. ovary '3", sepals '2-3" linear or linear-lanceolate. Fruit 1-3", ellipsoid acute or ovoid. Seeds '4-45", more or less compressed, closely inverted with an aril-like integument, ellipsoid, dark grey, nearly smooth or with corrugate margins.

The leaves are eaten as a sag and the fruit is also eaten when young.

NOTE.—The short-peduncled female plant has been repeatedly mixed up with *Luffa graveolens* and *L. echinata*, but the peduncle is rarely as short as in those species; the young fruit too is ovoid and beaked and the fimbriæ, though sometimes slightly hairy, are never hispid; the remains of the sepals form another useful character (cp. with those species).

10. BENINCASA, Savi.

A single species.

1. **B. cerifera, Savi.** Syn. *Cucurbita Pepo* (F.I.); Kumra, H., Beng.; Rakhsa, K.; The White Gourd Melon.

A rather large climber, softly hairy all over and with 2-fid tendrils. Resembles a *Cucurbita* in its large solitary axillary yellow flowers and foliaceous sepals, but the corolla is only *very slightly gamopetalous*. Flowers monœcious, the male with a longer peduncle than the female, hypanthium (with calyx) campanulate, sepals 5 foliaceous, pinnatifid or serrate. M. with 3 stamens with free exsert anthers, cells sigmoid. Fem. with densely hairy ovary, 3 flexuose stigmas and 3 parietal placenta. Fruit rounded-oblong, at first hairy, finally glabrous, 12-18" long with a whitish bloom. Seeds white, oblong, compressed, with tumid margins.

Fairly generally cultivated. Fl. Fr. c.s.

Leaves reniform-orbicular, 3-6" long and broad, deeply cordate and sometimes with small angular lobes, margin toothed; petioles hairy, 1-3", tapering above. Flowers about 2" diam.

The young fruit is eaten cooked and is also made into sweetmeats. It is said to be alterative, antimalarial, cooling and laxative, and is said to be a good antidote for many kinds of vegetable poisons.

11. LUFFA, Car.

Tendrils 3-5-fid. Fls. monœcious. Males in long racemes (except in *graveolens*) with a solitary male or solitary female from the same node, or female in a different axil. Bracts usually glandular. Male hypanthium obconic or campanulate. Corolla rotate from the top of the hypanthium or lining it to the base. Filaments 3-5 inserted at base of corolla tube, anthers free or in three groups, more or less exsert, cells sigmoid or sinuous on the margins of the often lamelliform connective. Fem. hyp. scarcely produced above the ovary which is narrow and ultimately 3- rarely 4-celled. Fruit ultimately dry with a very coriaceous or sub-woody epicarp and fibrous mesocarp, opening by a stopple.

The placentation in this genus becomes apparently axile or nearly so from the ingrowing of the placenta.

- I. Male flowers racemed, sometimes also a solitary one from same axil.
- | | |
|---|------------------------|
| A. Stamens always 3. Fruit covered with bristles | 1. <i>echinata</i> . |
| B. Stamens 3-5. Fruit not bristly. | |
| St. usually 3. Fruit sharply 10-angled | 2. <i>acutangula</i> . |
| Stamens usually 5. Fruit smooth | 3. <i>egyptiaca</i> . |
| II. Male flowers clustered. St. 5. Fr. softly bristly | 4. <i>graveolens</i> . |

1. *L. echinata*, Roxb.

A procumbent or scandent herb with 5-angled slender stems, distinctly 3-5-lobed ovate or broadly ovate deeply cordate and denticulate leaves 1-2.5" long and broad, somewhat hispid or hairy both sides and on the nerves beneath strigosely or hispidly hairy, cystolithic discs small when dry. Tendrils 2-branched. Fls. white .5-1" diam. Males in few flowered racemes 2-8" long with slender pedicels. Fem. solitary, often in same axil as males, with peduncle 3-8" long densely echinate with soft hispid spines. Capsule 1-1.3" long ellipsoid with bluntly conical tip densely spiny with rigid prickles.

Purneah, often near rivers! Fl. Sept.-Nov. Fr. Oct.-Jan.

There is considerable confusion in Herbaria in respect of this species, and I have omitted the Tirhut locality (of Bengal plants) as the so-called specimen from Darbhanga is *Momordica dioica* (in young fruit)! Another specimen is a *Cucumis*!

Leaves with somewhat hairy petioles about as long as themselves, with peculiar oblong glandular axillary bracts. Inflorescence more or less hairy, bracts oblong. Sep. 1" pubescent ovate or ovate-oblong. Petals obovate. Ovary with bluntly conical tip (quite different to the beaked ovary in *Momordica dioica*). Style 3-fid half-way down with large stigmas. Seeds compressed oval .15" grey-black slightly scabrous.

2. *L. acutangula*, Roxb., inc. *L. amara*, Roxb. Jui, Ho.; Paror Jhinga, S.; Jhinga, Ara-torui, H.; Tita Dhundul, Beng.

An extensive annual climber (very doubtfully distinct from the next species, *q.v.*) with orbicular smooth angled stems and orbicular angled or slightly 5-7-lobed leaves deeply cordate, 3-5" both ways, minutely closely scabrous above with tubercle-based points, more softly so beneath with short hairs, the tubercles or cystoliths at base of hairs never very large, margin dentate. Tendrils 3-fid. Male flowers racemed or sometimes paniced, sometimes only 1' long with glandular bracts near the base of the pedicel, sepals lanceolate .3". Fem. larger, solitary, often from same axil. Fruit 3-4.5" clavate or pyriform, narrowed at base to a stalk often its own length, 3-celled, tardily opening by a stopple and probably not always doing so. Seeds black .4" flattened, elliptic, rather broader one end, which is furnished with 4 grooves and small conical points, making it much resemble a beetle with a rough thorax.

Widely cultivated and wild or feral in several districts. Fl. r.s. Fr. c.s.

Along rivers in N. Champaran is an apparently wild plant with deeply-lobed leaves and only three stamens and smooth fruits. According to the usual diagnosis this should be *L. acutangula* but it really much more resembles *L. egyptiaca* (*q.v.*).

The unripe fruit of the cultivated plant is largely eaten as a vegetable. It is said to be demulcent, diuretic and nutritive. The seeds are emetic and purgative. The wild plant is very bitter and the fruit violently cathartic and emetic (*Nadkarni*, who calls the wild plant *L. Placketiana*, a synonym).

I would have combined this and the following were it not that *L. acutangula* is probably nearer the parent species, but if combined it would be necessary to call the species *L. egyptiaca* (the older name).

3. *L. ægyptiaca*, Mill. Doro, *M.*; Pulu, *Ho.*; Ghia Torui, *H.*; Dhundul, *Beng.*; The Egyptian Loofah or Towel Gourd.

A climber with very tough smooth sometimes angled stems, sulcate when dry. Leaves from orbicular to hastate-acuminate, often attaining 12", mostly 7-lobed with very deep basal sinus, other lobes shallow or deep, denticulate, minutely gland-pitted beneath when fresh and puberulous, especially on the nerves, scaberulous above or both sides with the hair-bases developing into small hard raised discs when dried and often pubescent on the main nerves; the lobes are usually well marked and acuminate. Petiole 3-5". Male racemes often 12-18" long, bracts spatulate-oblong .3" with 1-5 large round glands nearly covering their surface. Calyx widely campanulate, hypanth. .3-.35" long and sepals .5" lanceolate, corolla sulphur-yellow, spreading, 3-4" diam., thinly hairy. Stamens 5 or filaments connate at base in the case of two pairs or stamens 3, anthers very sinuous dehiscing on the lateral margins, filaments hairy below. Female peduncles 2-3", calyx glandular, sepals up to .6", corolla 4-4.5" diam. Staminodes on disc at base of corolla often 5, ovary appressed-villous, stigmas 3-4, 2-cleft. Fruit 6-18" cylindrical, not angled, but with 10 darker coloured stripes. Seeds grey or black with very thin margins, smooth or with small tubercles.

Cultivated and feral in all districts. Fl. r.s. and c.s. Fr. c.s.

I have little doubt that this is but a variety of the last and that the characters given to separate the two are not at all constant.

A feral form in the Ramnagar valley has 3 stamens or 4 stamens and absolutely cylindrical fruit 4" long. A feral smooth fruited *Luffa* in the Santal Parganas had 4 stamens. At Sidhao a similar plant in all respects to the Ramnagar plant was found except that it had 5 stamens! Sometimes 3-stamened forms easily split into 5.

The feral form has a fruit usually under 8" long. The cultivated fruit is eaten as in *L. acutangula*. The fibrous dry mesocarp constitutes the Loofah used for scrubbing brushes, stuffing saddles and other purposes.

4. *L. graveolens*, Roxb.

A slender climber with a "most disagreeable heavy smell" (*Roxb.*), stems somewhat villous but glabrescent, leaves cordate broad ovate to reniform 1.5-3" sinuate and denticulate. Tendrils 3-4-fid. Flowers yellow 1-1.5" diam., sep. ovate. M. sub-sessile. F. short-peduncled with 1-2 sub-orbicular or oblong glandular bracts on the peduncle which is only .2-.4" long. Young fruit beaked, narrowly ellipsoid, when ripe oblong nearly 2" long covered closely with soft spines and villous between, when ripe brownish-black. Seeds oval, compressed, black (*Roxb.*).

Purneah, *Kurz!* Rajmahal Hills, *Roxburgh!* It also occurs in the Sikkim Tarai, but the Chota Nagpur locality in Bengal Plants is, I think, an error. The only specimen (so called) from C.N. is in young fruit, and is *Momordica dioica*, *Roxb.!* The two can be distinguished by the tendrils, by the longer peduncle of *M. dioica* and absence of the glandular bracts and also by the broad scales and absence of villi in the latter, whereas the fruit of *L. graveolens* has narrow lanceolate scales or spines and intermixed villi. Fl. Sept.

12. THLADIANTHA, Bunge.

Climbing with simple rarely 2-fid tendrils. Leaves deeply cordate, denticulate. Fls. large (in our species), yellow dioecious, males racemed with often a one-fid. peduncle from same axil, bracteate or not, female peduncle elongate but only 1-fid. Hypanthium short

TILADIANTHA.] 71. CUCURBITACEÆ.

campanulate, the bottom shut by a horizontal scale, sepals lanceolate. Corolla campanulate 5-partite, lobes revolute about half way down. St. 5 inserted near mouth of hypanthium, anthers all 1-celled. narrow-oblong, straight. Ovary oblong, style deeply 3-fid with 3 reniform stigmas. Placentæ 3. Fruit ellipsoid baccate cylindric ribbed, with many seeds.

1. **T. calcarata**, Clarke. Syn. *T. dubia*, F.B.I.; *Momordica calcarata*, Wall.

A large climber with deeply cordate, neither angular nor lobed ovate leaves about 4" by 2½" acute, usually villous beneath. Male racemes with serrate or inciso-serrate bracts. Female peduncle 2-3" hairy. Flowers about 2" diam. golden yellow. Fruit 1½" oblong.

Dalsingsarai, Darbhanga, Prain's Collector! It is common in Eastern Bengal, Sikkim and Assam. Fl. r.s. Fr. Sept.
It resembles a *Trichosanthes* superficially.

13. CUCURBITA, L.

Stout hispid or hairy herbs with 2-4-fid tendrils and cordate ovate angular or lobed leaves. Flowers very large yellow solitary monœcious. Hypanthium above the ovary campanulate, sepals sometimes foliaceous. Corolla gamopetalous campanulate lobed less than half-way down. Stamens inserted low down, fil. 3 short, anthers connate in a column or club with conduplicate cells. Ovary oblong, style short, stigmas large, fleshy, 3-5, often longitudinally lobed. Large epigynous cushion-shaped disc 5-lobed. Fruit a pepo. Seeds ovoid or oblong compressed smooth, margined or not.

The ovary is filled with tissue and the ovules are on large swollen parietal placentæ which meet in the axis and are recurved.

The following limitation of species is according to Naudin and De Candolle:—

- | | | |
|---|---|----------------------|
| A. Leaves somewhat harsh and rigid. | | |
| L. with acute lobes, peduncles sulcate. | Corolla narrowed at base with erect lobes | 1. <i>pepo</i> . |
| L. with rounded lobes, peduncles not sulcate. | Corolla lobes curved outwards | 2. <i>maxima</i> . |
| B. Leaves soft. Indumentum fine and soft. | | |
| Sepals often foliaceous. | Peduncle pentagonal, expanded below the fruit | 3. <i>moschata</i> . |

1. **C. pepo**, DC. Karkaru, K.; Konrar, Kumra, Safed-kadu, H.; Pumpkin,* Marrow.

A stout hispid annual with orbicular shallowly acutely lobed leaves 4-8" diam. with soft hair between the hispidulous nerves beneath and also sometimes hispid with short bristles. Petiole 4-10" with rigid prickly hairs and also pubescent. Male peduncles 4", female 1½", strongly grooved in fruit. Hypanthium cupular villous with distant subulate sepals 1-2" hispidly hairy. Corolla usually 4" long and 4" diam., mid-rib sometimes excurrent, ribs hairy.

The most commonly cultivated species. Fl., Fr. chiefly r.s. De Candolle thinks it most likely Mexican in origin.

The species includes *C. malopepo*, L., and *C. ovifera*, L., and shows extraordinary variety in the shape and size of the fruit, either smooth and oblong as in the

* Both vernacular and English (or American) names such as Pumpkin, Squash, etc., are often loosely applied, and to the fruit rather than to the plant.



71. CUCURBITACEÆ. [14. CEPHALANDRA.]

CSL

Vegetable Marrow, pear-shaped, covered with small knobs (*Barberine*) round and depressed, dish-shaped, etc. The flesh is usually pale and scentless.

2. *C. maxima*, *Duchesne*. The Gourd, Lal Kumra (when flesh is red), *H.**

Besides the characters given in the Key it differs chiefly from the last by the absence of the prickly hairs on the petiole. The fruiting peduncle is striated but not grooved.

The fruit attains an enormous size and is usually oblong but varies in shape almost as much as does *C. pepo*. The flesh is often reddish.
De Candolle considers it to be of African origin.

3. *C. moschata*, *Duchesne*. The Musk Melon.

The species is easily recognised by its general softness, the fruiting peduncle being pentagonal and enlarged beneath the fruit which is more or less covered with a glaucous bloom. The sepals are most frequently terminated by a broad foliaceous tip and the flesh of the fruit is usually somewhat musk-scented.

Commonly cultivated! Its native country is entirely unknown.

14. CEPHALANDRA, *Schrad.*

Climbing herbs with simple tendrils and 5-angled or -lobed or -partite leaves. Flowers rather large, dioecious, solitary, or males in abbreviated racemes, axillary white, ebracteate. Hypanthium campanulate or funnel-shaped, short. Corolla campanulate, lobed about half-way down. St. 3 with exsert connate anthers and conduplicate anther-cells. Ovary oblong, style long with 3 bifid stigmas, placentæ 3. Fruit smooth fleshy cylindric. Seeds ovoid compressed margined.

1. *C. indica*, *Naud.* Syn. *Coccinia indica*, *W. & A.*; Kundri, *K.*; Kanduri, *Bhimb, H.*; Ban-kundri, *Or.*; Tela-kucha, *Beng.*

Stems 5-angled, somewhat scabrous or smooth. Leaves 1.5-3.5" rarely 4", ovate or orbicular, variously 3-5-angled or -lobed and the lobes occasionally constricted at the base and again lobulate, but always easily recognisable by their being glabrous, delicately venose beneath but marked with numerous small round discs above, base 5-nerved and nervules usually ending in glandular distant denticulations, frequently several large circular glands near the petiole, petiole .5-1.5" long. Male flower solitary or 2-4 clustered on a very abbreviated rhachis. Pedicels .3-.6" long. Sepals spreading subulate or oblong acute .15-.17" long. Corolla 1-1.2" long and 1.5" diam. campanulate with large spreading ovate-lanceolate lobes papillosely hairy within. Stigma spreading. Fruit oblong narrowed apically or at each end, scarlet when ripe but green with usually 10 white streaks when unripe.

Common in hedges in most districts! Also cultivated as a vegetable. Fl. Aug.-Dec. and sometimes again seen in flower in March. Fr. soon after.

A form found in the Mals of Orissa has fleshy rather glaucous leaves with the margins sparsely scabrous-ciliate.
The fruit is largely eaten.

* See note on previous page.

FAM. 72. BEGONIACEÆ.

1. BEGONIA, L.

Succulent herbs, often rhizomatous or tuberous, with alternate simple more or less unequal-sided palminerved leaves with cystoliths and free stipules often persistent. Flowers usually showy mostly in terminal or axillary dichasial cymes, monoecious and usually bilateral, rarely quite regular. Male perianth of two outer valvate opposite petaloid tepals and 2-0 inner smaller ones (petals?), perianth of female of 2-5 tepals (rarely 6-8), if more than two imbricate, the outer 2 more or less covering the inner, superior. Stamens many, free or monadelphous, anthers with a large clavate connective. Ovary completely enclosed in the hypanthium, inferior, 2-4-celled with axile divided or simple placentæ, 2-4 free or partially connate styles and variously shaped stigmas. Ovules very many. Fruit usually capsular, often winged, dehiscent or irregularly breaking up. Seeds very many minute, terete or globose with reticulate testa and scanty or 0 albumen.

1. *B. picta*, Sm.

A pretty little plant, varying in size from one leaf an inch or two long and peduncles 4" high to several leaves and flowering stem 18" high. Stems hairy. First leaf radical, later usually few, bronze-green above and crimson beneath, broadly ovate cordate sometimes shortly acuminate, margin unequally dentate with teeth ending in hairs, upper surface rough with tubercle-based hairs, lower with some hairs on the nerves; in favourable localities they attain 9.5" by 8.5", and with a petiole 10.5". Fls. pink, M. and F., on separate branches of the inflorescence. Larger M. tepals .5-7" ovate. St. many monadelphous, yellow. F. fl. 5-tepalous, 2 outer up to 8". Ovary and capsule 3-winged or one wing obsolete, closely covered with crystalline branched hairs (very pretty when fresh), placentæ 2-fid.

Chota Nagpur, esp. on the plateau on damp banks under shade, common! Sambalpur! Fl. Aug.-Oct. Fr. Sept.-Jan.

I have a field-note of a plant with 5 small white petals, but it was not collected. It may be a variety of the above.

FAM. 73. CACTACEÆ.

Succulent plants, sometimes arboreous, with columnar, club-shaped, spherical or terete, compressed or angled, ribbed or warted stems and branches, rarely as in *Pereskia*, with well-formed leaves, but leaves reduced to small subulate minute often caducous scales or subulate and fleshy with tufts of hairs, bristles, or spines in their axils.* Flowers axillary or terminal on special tubercles, usually large and showy, generally solitary, in *Pereskia* in several-fid. cymes. Perianth regular or somewhat zygomorphous, not evidently separable into calyx and corolla, rotate, funnel-shaped or salver-shaped, of many superior tepals from a tubular hypanthium. Stamens very many, inserted at various levels in the hypanthium. Ovary inferior

* The small area or cushion thus formed is here termed an "areole."

1-celled with several parietal placentæ. Ovules many anatropous with two integuments (as in most Polypetalæ). Fruit baccate 1-celled. Seeds many with curved embryo which is cylindric or club-shaped and scarcely differentiated or with two thin or fleshy cotyledons, albumen scanty or copious.

The germination of *Opuntia* (the only one I have observed) is epigeal with two normal small rather fleshy cotyledons, between which at once arises a clavate fleshy stem without intermediate more normal forms of stem.

Only the naturalised or semi-naturalised species are here dealt with; several others are found in gardens, especially epiphytic species of *Rhipsalis* with flattened 2-ridged serrate branches.

I. Leaves reduced to scales.

A. Barbed bristles 0. Stems columnar, strongly ribbed or angled.

Flowers salver-shaped or funnel-shaped with tubular hyp. . . 1. *Cereus*.

B. Areoles with barbed bristles. Stems with broad flattened joints.

Fls. rotate or funnel-shaped. Stamens not exerted . . . 2. *Opuntia*.

Fls. campanulate. Stamens far-exserted . . . 3. *Nopalua*.

II. Leaves well-developed. Flowers cymose . . . 4. *Pereskia*.

1. CEREUS, Haw.

Stems either erect and attaining large girth or slender and scandent with climbing roots or epiphytic, columnar in form with strong prominent ridges or angled or ribbed. Leaves reduced to scales often only developed in the earliest stages. Areoles with felted hairs with more or less numerous prickles. Flowers from the older areoles solitary, large, erect, salver-shaped or somewhat zygomorphous with very unequal spirally arranged tepals, of which the lowest often clothe the hypanthium outside the ovary, the median are calyciform and the inner petaloid. St. included or exerted from the hypanthium with long filaments. Ovules with long funicles often connate in groups on the large swollen placentæ. Berry very succulent, smooth or tubercled.

1. *C. hexagonus*, Haw. Bonga-daru, K.; Sapin, S.; Soju, Mal., P.

Stems several from the root, tall columnar with usually sharply 6-ridged stems covered with clusters of sharp spines but no barbed bristles. Fls. large solitary, funnel-shaped, white, somewhat zygomorphous.

Frequent in village hedges. Chota Nagpur! Santal P.! Puri! Balasore! Fl., Fr. May-Sept.

There is some doubt about the name as specimens and notes are both deficient. The description of *C. hexagonus* in Britton and Rose (*The Cactaceæ*, Washington, 1919) is as follows: Up to 15 metres high, joints 12 cm. diam. or more, short, ribs 4-7, usually 6, thin, 3-5 cm. high. Fls. 20-25 cm., tube slender, 10 cm., uppermost scales green, short, outer tepals lanceolate to oblong-lanceolate, 6-7 cm., tinged with purple, inner much thinner, white, oblong-lanc., 7-8 cm. Fruit pale red, ovoid, 7.5-13 cm., somewhat oblique.

Burkill in *Records of Bot. Surv. of India*, 1911, apparently calls this *C. pterogonius*, Lam., but the habit of the latter plant is entirely different.

2. OPUNTIA, Haw.

Shrubs with the stems often woody, branches jointed with large, fleshy and compressed limbs bearing when very young small cylindrical or subulate caducous leaves leaving axillary scars or

"areoles" from which arise very numerous fine barbed bristles and often one or more larger prickles or spines. Flowers solitary, large or mod.-sized from the marginal or apical areoles, usually yellow or reddish, regular, rotate or funnel-shaped. Outer tepals sepaloid, inner numerous petaloid. Stamens shorter than the perianth, inserted on the cupular or saucer-shaped hypanthium, of which the upper part falls off with the perianth and stamens. Ovary sunk in the hypanthium (which does not differ from the rest of the axis and bears areoles, and if broken off and planted will behave like a cutting and grow!). Ovules few or very many, enveloped by the much expanded end of the funicle.

- A. Spines deciduous except one large one (rarely 2-3) on each areole 1. *monacantha*.
B. Several large spines usually remaining on each areole.
1. Spines straight slender tawny, brown or black. 2. *elator*.
Fls. lemon yellow changing to rose-pink var. *nigricans*.
Fls. orange 3. *Dillenii*.
2. Spines all pale yellow, the largest stout and rarely also curved
1. **O. monacantha**, Haw. (*Suppl. Plant. Succ.*, 1819). Syn. *Cactus indicus*, Roxb.; Nagphani, Vern.

A large succulent jointed shrub with erect branches and with the limbs (the internode-like portions of the axis between the articulations) much compressed obovate to oblanceolate, bright-green. Areoles bearing 1-3 spines only, of which at least one is often over 1" or 2" long, often brown or whitish and dry-looking. Flowers yellow or only reddish outside, corolla spreading rotate, stamens yellow short, pistil longer than the stamens. Fruit green, nearly smooth.

Apparently more plentiful in the damper districts (possibly through the absence of its enemies), Purneah, Chandpur (Balasore), Cuttack and Puri, frequent! Singbhum! *Burkill** records also the following localities: Darbhanga, Muzaffarpur, Samastipur, Dalsing Sarai, Gaya (1856, *Kurz*) and Ranchi (*Wood*). Fls. chiefly in the h.s., also January, opening during sunshine.

The limbs of this species like other *Opuntias*, being branches, usually decrease in size from below upwards, so that it is difficult to give measurements, and the young ones bear small sessile subulate fleshy leaves. Outer petals smaller, obcordate, inner oblong.

This cactus is eaten by the Cochineal insect, which on introduction caused its destruction over large areas in India.

2. **O. elator**, Mill. (*Gard. Dic.*, 1768), int. *O. nigricans*, Haw.
Tall Indian Fig.

Habit of last with compressed limbs of much the same shape (usually described as ovate-oblong), but frequently faintly faceted by slightly raised lines joining the areoles, somewhat glaucous. Areoles with 2-5 strong divaricate tawny or purplish-black spines. Flowers yellow soon becoming tinged with purple or outer petals red and inner dirty yellow, perianth somewhat campanulate, stamens purple, pistil shorter than the filaments (always?). Hypanthium with tufts of bristles and a few spines. Fruit red marked with the areoles, but bristles and spines deciduous, top depressed.

Exceedingly common in the Arrah and Patna districts, *Burkill*. Purneah, *Burkill*. Very plentiful in Orissa, *Burkill*.

* Records of the Botanical Survey of India, 1911.

The stems become woody below with age. Leaves subulate compressed above.

Var. *nigricans*, Haw. (*Miscellanea Naturalia*, 1803), sp.

I do not see how *O. nigricans* is to be separated as a species from *O. elatior*. The characters given appear trivial, such as the flowers being orange (as contrasted with lemon-yellow changing to rose-pink) and the spines black. Bankipur, *Burkill*.

The Cochineal insect does not feed on it.

3. *O. Dillenii*, Haw. (*Supp. Plant. Succ.*). Nagphani, Vern.

A large straggling fleshy shrub with often drooping branches and large flat limbs, lower often longer and corky, median about 11-15" long and only about 3" thick, mostly oblanceolate, articulations often with a ring of spines or bristles when young. Young leaves subulate fleshy 2", sub-spinulose, seated on a swollen fleshy base (petiole?), in the axils of which are the rudimentary bristles and tomentum. Areoles finally with 5-6 (more rare only 2-4) very pale yellow spines and numerous yellow barbed bristles. Flowers entirely pale sulphur yellow or greenish-yellow or slightly tinged with red within at the base towards evening, somewhat funnel-shaped, with petals about 2" long. Hypanthium narrowly turbinate with areoles like those on the young limbs, white tomentose but without spines or bristles (the latter sometimes present?).

Arrah, Bankipur and Patna, *Burkill* (*loc. cit.*). A very common species about Litipara and Hirampur in the Santal Parg. Singbhum! Puri, very common!

Fl., Fr. June-Sept. Flowers open in the morning and close in the evening.

Burkill gives as a distinctive character that some of the spines are always curved, "the largest stout, light horn-coloured in life, darkening in herbaria with age," but I do not often find these curved spines. He probably includes the Puri species in "*elatior*" as he does not mention *Dillenii* from that region!

It is the principal species used for fencing the Casuarina plantation on the Puri sands, and makes a thick effective hedge on sandy soil. Easily grown from cuttings.

3. NOPALEA, *S. Dyck*.

Flowers campanulate with very many tepals, the outermost scale-like. Stamens far exceeding the perianth. Ovules embraced on two sides by the long flattened funicle. The rest much as in *Opuntia*.

1. *N. coccinellifera*, *S. Dyck*. Syn. *Opuntia cochinelifera*, *Miller*.

Limbs fleshy obovate without spines on the areoles.

Only recorded from Shahabad (Arrah), *Burkill*.

4. PERESKIA, *Plum.*

Succulent shrubs with thick twigs and broad more or less fleshy leaves in the axils of which are areoles and clusters of spines. Flowers cymose axillary or in terminal panicles, rotate, regular, medium-sized. Tepals many free or connate, the outer usually short and fleshy green or harder and almost prickly, the inner petaloid. Stamens inserted on the margin of the saucer-shaped or cupular hypanthium which is somewhat swollen above the ovary but not produced into a tube. Ovary inferior 1-celled, or 3-celled at the top. Ovules few or many, parietal or pendulous anatropous. Fruit baccate globose or pyriform, sometimes with prickles. Seeds few, elegantly sculptured with lines. Embryo curved with the large cotyledons rolled round one another.

1. *P. bleo*, DC. Barbadoes Gooseberry.

A large shrub armed on some branches with long needle-like spines. L. alternate or fascicled, fleshy, narrowly-elliptic oblong acute 2-3", shining, sec. n scarcely visible. Flowers pretty, pink, 1.5" diam. in dense cymose panicles the ultimate branches of which resemble peduncles, with many bracts. Outer 4-5 tepals calyciform short and green, several intermediate tepals gradually passing into petals, the innermost 5-7 being distinctly petaloid 7-8" long. Stamens very many with free slender filaments shorter than the petals and yellow anthers. Style long, stigma capitate deeply (about 7-) -grooved.

In gardens and hedges and almost naturalised in some parts of Ranchi. Fl. March-April and also at other times.

2. *P. aculeata*, Plum. The name Barbadoes Gooseberry is more correctly applied to this species. It is sometimes found in gardens and has a pair of hooked spines in each axil and white flowers. The fruit is edible.

FAM. 74. UMBELLIFERÆ.

Herbs with usually fistular stems, compound (simple in *Bupleurum* and *Hydrocotyle*) and often much dissected alternate leaves with a sheathing petiole, exstipulate or rarely stipular. Flowers small white or yellow, more rarely pink, in simple or compound umbels, 2-sexual or polygamous, rarely diœcious, regular or the outer in an umbel sometimes irregular with the outer petals larger (*radiant*). Sepals superior, usually very small or 0. Petals 5 inserted under the epigynous disc often emarginate with an inflexed tip and a median fold, imbricate or valvate and involute in bud (exc. *Hydrocotyle*). Stamens 5 inserted under the disc which is usually tumid and 2 lobed and surrounds the styles. Ovary inferior, 2-celled styles 2. Ovules 1 pendulous in each cell. Fruit 2-coccons, usually ridged and with oil-canals (*vittæ*)* in the pericarp. Seed 1 in each coccus albuminous. Embryo small, radical superior, cotyledons linear, often unequal or oblong.

The plane of separation of the two carpels is called the *commissure*. In the centre is a vascular system forming ultimately a distinct slender entire or forked axis (carpophore), from which the ripe carpels sometimes remain for a time suspended, but this is not always differentiated. Each coccus has normally 5 primary ridges, viz. 1 *dorsal*, 2 *marginal* or lateral, next the commissure, and 2 *intermediate*, i. e. one each side between the dorsal and marginal ridges. In some species there are 4 other ridges whose positions are alternate to these; they are called secondary ridges and are in a few cases more prominent than the primary.

The germination is epigeal.

Umbels simple or sessile. Leaves simple sub-orbicular 1. *Hydrocotyle*.

Umbel compound (capitate in *Pyrenocela*):—

I. Leaves entire, usually very narrow. Fls. yellow 2. *Bupleurum*.

II. Leaves compound (radical rarely simple and ovate):—

A. Primary ridges most conspicuous, *vittæ* in the furrows between them:—

1. Fruit narrowest at the commissure, in horizontal section didymous or laterally compressed.

Vittæ solitary in the furrows. Bracts 0 to many 3. *Carum*.

Vittæ 2 or more in the furrows. Bracts 0 or few 4. *Pimpinella*.

* The *vittæ* are often externally visible in the ripe fruit as dark streaks; they show under the microscope in transverse section as minute holes in the pericarp.



2. Fruit widest at the commissure, in horizontal section circular or somewhat dorsally compressed, lateral ridges, if winged, distinct, not connivent.
 - a. Ridges not winged.
 - i. Umbels capitate, heterogamous. 5. *Pycnocycla*.
 - ii. Umbels not capitate, fls. similar or outer radiant. Fls. white or pink. Primary ridges strong, hairy. 6. *Seseli*.
Fls. white or pink. Lateral ridges large corky. 7. *Eranthe*.
Flowers yellow. Leaves cut into filiform segments with connivent wings. 8. *Foeniculum*.
9. *Ligusticum*.
 - b. Primary ridges sub-alate or alate. 10. *Peucedanum*.
3. Fruit very wide at the commissure, much dorsally compressed, in transverse section lenticular, lateral ridges with connivent wings. 11. *Coriandrum*.
- B. Secondary ridges of the fruit more conspicuous or at least as strong as the primary. Vittæ under the secondary ridges, often obscure:—
 - Fruit globose, smooth. Bracts 0 12. *Daucus*.
 - Fruit echinate. Bracts pinnatisect

1. HYDROCOTYLE, L. Marsh Penny-wort.

Creeping herbs with usually orbicular simple cordate entire angled or lobed palmi-nerved leaves and small scarious stipules. Fls. minute white or red in small simple axillary or sessile compound umbels, bracts usually present. Sep. minute or 0. Petals entire. Fruit strongly laterally compressed, vittæ obscure or 0.

- L. '5-2.5" diam., not lobed. Bracts 2 (rarely 3-4) broad-ovate. Fls. few 1. *asiatica*.
L. '25-75" diam., lobed. Bracts obscure. Fls. 10-15 2. *rotundifolia*.

1. *H. asiatica*, L.

A variable herb with long creeping stems rooting at the nodes, young leaves and petioles villous, never quite glabrescent. L. orbicular-reniform never lobed but often with large rounded crenatures or sometimes coarsely dentate or sub-entire. Umbels usually several at a node, perhaps representing a sessile compound umbel, each with a pair of ovate sub-amplexicaul bracts 1-15" long. Fls. 3-5 rarely 6 in an umbel, sub-sessile, petals deep-red ovate acute or obtuse imbricate. Stamens red. Fr. with very narrow commissure, didymous, cocci 11-13" diam. broader than long or as long, cocci with 5 primary ridges strong, sometimes with 2 or 4 of the sec. ridges also developed or the intermediate spaces venous, thinly pilose, epicarp very thick corky and endocarp thin. Seed much laterally compressed.

In wet places. Ranchi plateau! Singhbhum, side of malas in the hills! Mayurbhanj Mnts.!

The characters given above will be seen to break down the distinction of the sections of the genus given in the *F.B.I.* The species is however easily separable from *H. jaccanica* by the few fld. umbels, large ovate bracts and thick-walled fruits. The following varieties look very distinct superficially:—

Var. *a*. Leaves 1.5-2.5" diam., very villous before expansion (the margins are rolled inwards in bud). Petioles 1-4.5". Peduncles up to 1" long. Bracts pink and pubescent when in flower. A form of this has true compound umbels with the rays 25" long and bracts 2-3 lanceolate-ovate! Fruit white.

Chota Nagpur! Fl., Fr. Nov.-Jan.



Var. 3. Leaves under 1" diam., less villous. Petioles '5-1". Peduncles 2-4 under '5". Fruit reddish.

Mountains of Orissa! Fl., Fr. May.

2. *H. rotundifolia*, Roxb.

A much more delicate plant than the last species though somewhat resembling the last variety of that species. Leaves membranous distinctly 5-7-lobed or lobulate with the lobes or lobules crenate; rarely exceeding '7" diam., with scattered short hairs beneath. Petioles '5-1'5" very slender. Peduncles glabrous '1-75" long, 10-15-flowered with very minute bracts, flowers sessile. Fruit somewhat compressed, angled from the prominent primary ridges, glabrous, '08" with hard thin pericarp.

Higher hills of Chota Nagpur. Neterhat, near streams, elev. 3000 ft.! Fl., Fr. r.s.

2. BUPLEURUM, L.

Glabrous with entire, often grass-like leaves and small yellow flowers in compound umbels with the bracts and bracteoles foliaceous, setaceous or 0. Sepals 0. Petals obovate, emarginate. Fruit laterally compressed somewhat constricted at the commissure with terete or sub-pentagonal cocci and distinct rarely obscure primary ridges, vittæ 1-3 between the ridges, rarely 0 or many. Seed terete, rarely slightly grooved on the inner face.

Bracts 3-5, '15-2", bracteoles, exceeding the pedicels	1. <i>mucronatum</i> .
Bracts 0-2 under '15". Bracteoles not half as long as the very slender pedicels	2. <i>falcatum</i> , var. <i>biharensis</i> .

1. *B. mucronatum*, W. & A.

A tall much-branched herb (up to 6 ft.) with often flexuous stem, grass-like leaves up to 6" long often mucronate at the tip, small yellow fls. in much paniced umbels, 3-5 conspicuous lanceolate bracts '15-2" long and bracteoles exceeding the pedicels and carpels. Carpels elliptic or oblong.

Higher mountains of Chota Nagpur. Sarguja, Clarke! Bistrampur, Prain's Coll.! Fl., Fr. Oct.-Jan.

Leaves often much attenuate towards the base and sometimes sub-obtuse scarcely amplexicaul, primary nerves between midrib and not very prominent margin 2-3 rarely 4.

2. *B. falcatum*, L. Var. *biharensis*, Haines.

An erect slender not much branched herb up to 3-4 ft. with grass-like leaves 5-6" long by '3" broad acuminate at the tip, small yellow fls. in umbels with 1-2, or 0, inconspicuous bracts up to '15" long and bracteoles 4-5 lanceolate cuspidate not half as long as the '15-2" long very slender pedicels. Pedicels 4-7 rather exceeding the '15" long narrowly oblong carpels.

Higher mountains of Chota Nagpur. Neterhat! Fl., Fr. Sept.-Jan.

Cauline leaves slightly narrowed to the amplexicaul base with a prominent white margin and 4 primary nerves between midrib and margin.

This differs from the type which is a Himalayan plant in the short bracteoles and long pedicels, which in the type are less than half the length of the fruit.

3. CARUM, *L.*

Annual or perennial with pinnate to decomposed leaves and compound umbels with few or many bracts and several to many bracteoles. Flowers white or pink polygamous, outer usually sterile often with radiant petals. Sepals small or 0. Petals retuse or emarginate. Fruit ovoid ellipsoid or oblong, laterally compressed and constricted at the commissure (didymous), cocci glabrous, papillose or muricate isodiametric, sub-pentagonal, plane on the inner face with slender conspicuous or obscure primary ridges, 1-vittate between the ridges. Seed terete or slightly dorsally compressed, plane or slightly grooved on the inner face.

- | | |
|--|---------------------------|
| A. Ovary (hypanthium) glabrous or pubescent. Rays 3-12. | |
| L. ternately divided, segments forked or again ternate,
linear to lanceolate. Rays 3-6 glabrous. Fruit dotted or
hispidulous | 1. <i>stictocarpum</i> . |
| As in <i>stictocarpum</i> , but fruit hispid, '08-1" | 2. <i>Roxburghianum</i> . |
| L. 2-3-pinnate, segments linear to filiform. Rays 4-12. | |
| Ovary pubescent, fr. muricate sub-hispid | 3. <i>copticum</i> . |
| B. Ovary very villous. Rays 18-30, villous-pubescent | 4. <i>villosum</i> . |

1. *C. stictocarpum*, *Clarke*.

A herb 1.5-2 ft. high with many slender leafy branches and 1-2-pinnate leaves with the pinnae and their segments usually 3 only but 5 on the lower leaves, ultimate segments linear-lanceolate glabrous. Fls. minute, white or pinkish in many small umbels with usually 3-6 slender rays .5-2" long, rarely rays up to 12 (*Clarke*), bracts linear-setaceous to linear-lanceolate 6-8 with scarious ciliate margins. Ovary pubescent or (var. *hebecarpa*, *Clarke*) scarcely puberulous. Frt. under .06" shining yellow with microscopic dots or in var. *hebecarpa* up to .08" and hispidulous.

This I have found throughout the Higher Vindhyan range from Pachmari, through the Balaghat plateau to the Mountains of Bilaspur, and it probably enters our area but has not been seen in flower or fruit there. The western form has nearly glabrous fruits but the eastern one is *Clarke's* variety *hebecarpa* which passes into the next species. Fl., Fr. Oct.-Feb.

2. *C. Roxburghianum*, Benth. Ajmud, H.

A slender plant 1-3 ft. high, much branched, the leaves cut into slender linear-lanceolate or obcuneate often lobed segments. Rays slender usually 4-5. Pedicels 6-14. Ovary pubescent. Fruit densely hispid-pubescent '08-1'.

Kishenganj, Purneah, Kurz! Fl. Sept. to March. Fr. April. Cultivated.

This, as *Clarke* says, is probably only a cultivated form of the last. It differs only in the fruit which is more distinctly ridged and more pubescent. The fruit is used in curries and as a carminative medicine.

3. *C. copticum*, *Benth.* Ajowan, *H.*

A very slender plant 1-2 ft. high minutely pubescent or glabrescent with 2-3-pinnate leaves, the ultimate segments very slender linear or filiform. Bracts several, rarely 0, sometimes divided, linear. Rays usually about 10 slender '5-15', pedicels 6-20 more or less pubescent, bracteoles 3-5 small linear. Fruit ovoid '08" muricate or densely papillose-hispid, ridges usually distinct making the cocci sub-pentagonal.

74. UMBELLIFERÆ.

Sahebganj, Kurz! Cultivated. Fl. Feb.-May. Fr. May.
The seeds have an aromatic smell and warm pungent taste. They are used as spices and as a carminative. *Nadkarui* states that the plant is a source of Thymol.

4. *C. villosum*, *Haines* (*Journ. As. Soc. Beng.*, xv, No. 7, pl. ix).

Stems 2.5-3 ft., pubescent, very leafy below. L. lower 2-3-pinnate and pinnatifid; upper 2-pinnate ovate, ultimate segments narrow-oblong or cuneate and lobed, minutely pubescent above, puberulous on the nerves beneath, segments or lobes mucronulate. Umbels 2" diam., very long peduncled dense-flowered. Rays 18-30 villously-pubescent 5-8". Bracts about 10 linear 2-3". Pedicels 25-30, 1-15". Bracteoles about 10, 1" long filiform. Hypanthium densely villous. Calyx obsolete. Petals white .03-.04" not including the long inflexed tip, thinly pilose. Disc flattened above, 2-lobed. Styles long slender.

Sandstone Hills of Ramnagar, N. Champaran! Fl. Dec. Root rather woody and apparently perennial.

The fruit is unfortunately not known, so no Latin description of the species has yet been published.

4. PIMPINELLA, L.

Biennial or perennial herbs with the first year's leaves sometimes simple, cauline leaves 1-2-pinnate or decompound but sometimes simple (on the same plant and heteromorphous). Bracts few or 0, bracteoles usually linear sometimes 0. Flowers 2-sexual or polygamous. Sepals minute or 0. Petals with a long inflexed point. Fruit usually didymous, laterally compressed, ovate or ovate-oblong. Cocci terete or sub-pentagonal, plane on the inner face, ridges slender, obscure or prominent, vittæ 2-3 in the furrows. Seed with inner face plane or nearly so.

A. Leaves sub-similar. Disc 0.

L. 3-7-foliolate, i. e. 3-foliolate or with one pair of 2-3-foliolate pinnae. Bracts 0

1. *Heyneana*.

B. Radical and sometimes lower cauline leaves 1-3-foliolate with very large ovate-lanceolate lfts. Upper different. Disc prominent.

Rays glabrous, bracts 0

2. *monoica*.

Rays hispidulous-pubescent. Bracts several

3. *bracteata*.

1. *P. Heyneana*, *Wall.*

A slender erect branched herb 1-3 ft. high with glabrous striated stem and 1-2-ternately compound leaves, usually orbicular in outline. Fls. minute in leaf-opposed umbels 1.5-3" diam. Bracts 0, bracteoles 0-1, rarely 2 setaceous, .25" or less long. Fruit didymous, broader than long, glabrous ridges slender, primary often pale and conspicuous when dry.

Damp places under shade, Chota Nagpur, frequent! Fl. Oct. Fr. Dec.-Jan.

Lower petioles about 2" long. Lfts. rarely 2" long, lanceolate or ovate-lanceolate, sharply deeply often doubly serrate, sparsely puberulous both sides. Peduncles 1.5-4". Rays 4-14, 5-15" long with 6-16 unequal glabrous pedicels 1-5". Cocci .08", vittæ about 8.

2. *P. monoica*, *Dalz.*

A biennial herb 3-4 ft. high with striate stems very copiously corymbosely branched. First year leaves radical 3-foliolate with

ovate-lanceolate cordate leaflets, cauline leaves of second year pinnately 3-5-foliolate, lfts. ovate-lanceolate acuminate spinulosely serrate, upper linear with linear lobes. Umbels 1-2" diam. very numerous terminating all the branches with small white flowers without bracts. Bracteoles 0-2. Frt. minutely papillose ovoid compressed .07" long. Carpels each with 3 distinct primary ridges with 2 vittæ between, sub-pentagonal with plane inner face.

Highest mnts. of Chota Nagpur. Ranchi and Palamanu 2500-3000 ft ! Neterhat ! Fl. Nov.-Dec. Fr. Dec.-Jan.

L. glabrous or with short hairs both sides. First year's leaflets 3-5" doubly crenate-serrate, crenatures sub-spinulose, base of leaflet often very oblique 5-nerved, petioles and petiolules long. Such leaves are occasionally found on the lower part of the stem in the second year. Upper petioles reduced to sheaths with ciliate margin. Rays of umbel glabrous (pubescent in plants outside our area) 8-13 slender .5-1". Fls. .06-.08" diam.

3. *P. bracteata*, Haines (*Journ. As. Soc. Beng.*, xv, No. 7, p. 314).

A stout biennial 3-4 ft. high with striate stems branched above. First year's leaves much as in last but more pubescent and crenatures mucronate. Cauline leaves (of second year) lower 3-5-foliolate with ovate leaflets like the radical, leaflets of upper lanceolate, uppermost pinnatifid with linear-lanceolate lobes ending in sub-spinulose tips. Umbels 1-2" diam. with about 6 linear bracts .2-5" long and 3-5 bracteoles .1-2" long. Fruit minutely papillose, glabrescent.

Highest mnts. of Chota Nagpur. Ranchi and Palamanu 2500-3000 ft ! Neterhat ! Fl. Oct.-Dec. Fr. Jan.

Stems and leaves pubescent or hispidulous both sides esp. on the nerves. Radical and lower cauline leaflets sometimes sub-orbicular. Lateral leaflets sometimes falcate, lateral petiolules 0-6". Uppermost petioles reduced to sheaths. Rays of umbel 8-12 pubescent .5-8" long. Fls. .08-1" diam. Pedicels .2-3".

5. PYCNOCYCLA, Lindl.

Perennial herbs with rush-like few-leaved stems. Leaves pinnately dissected with narrow segments. Umbels short-rayed or capitate with many small bracts and bracteoles. Flowers only one perfect central in each umbellule, sessile, surrounded by several pedicelled males. Hypanthium hairy, sepals small lanceolate, often unequal. Petals obovate emarginate hairy. Fruit oblong lanceolate hairy, one carpel often abortive, surrounded by the inflated pedicels of the barren flowers. Fruit cocci with inner face deeply grooved, primary ridges filiform, vittæ numerous, very slender, scattered. Seed lunate or with a T-shaped groove on the inner face.

1. *P. glauca*, Lindl.

An interesting Umbellifer with woody root-stock, rush-like stems 8-18" high (including peduncle), terete, striate and glaucous, ultimate segments of the leaves filiform sub-terete .5-3" long. Flowers white or purplish collected in heads resembling those of a Scabious or Composite. Heads about .5-1" diam. terminal on long pubescent peduncles. About 7-8 males or neuters envelope and enclose one fruit which attains about .65" long.

Grass lands of the Chota Nagpur plateaux. Tongo (Ranchi) *Brassica*! Tagore's Hill (Ranchi), *Caster*! Neterhat! Fl., Fr. May-Nov.

6. SESELI, L.

Leaves 2-3-pinnate or twice 3-partite. Bracts few or many, sometimes pinnate, bracteoles several or many. Sepals minute or 0. Petals emarginate pink or white. Fruit oblong, ovate or spherical, not laterally compressed but usually widest at the commissure. Cocco with inner face plane, rarely concave, ridges strong, often hairy, vittæ one in each furrow. Disc not prominent on the fruit. Seed semi-terete.

1. *S. indicum*, W. & A.

A carrot-like herb with spreading and erect striate very pubescent branches from the root, 12-18" high. Radical leaves oblong or oblong-lanceolate 4-7" with the petiole, 2-pinnate or pinnae pinnatisect 2-3 prs., larger 1.5" with ovate pinnatifid pinnules and lobulate obtuse apiculate segments, cauline similar but smaller and more crisped, all hairy especially beneath with short white hairs. The fruit in this species is not always widest at the commissure, primary ridges strong, densely glochidiate.

Not common. Mahanadi River bed and other sandy places, Angul! Fl., Fr. Feb.-April.

Peduncles leaf-opposed 2-4". Flowers white or pink 1" diam. in dense umbels 1-2.5" diam. with about 15 rays, 8" (somewhat longer in fruit) long, hairy, bracts 2.5-3" spreading in flower, reflexed in fruit, 8-9 linear-subulate green with scarious margins, bracteoles similar but smaller. Pet. broadly ovate with long inflexed tip.

In Upper India the ridges of the fruit are very strongly developed and glabrous, and so they are in Roxburgh's figure.

7. CENANTHE, L.

Herbs growing in wet places, sometimes creeping or stoloniferous. Leaves 1-3-pinnate. Umbels with 0 or few bracts and several linear bracteoles, sometimes radiant with polygamous flowers. Sepals small or outer m.s. Petals emarginate or with long inflexed point. Fruit glabrous, globose or longer than broad with broad commissure. Cocco semi-terete with inner face plane, lateral primary ridges large and corky, others subequal or very small or obsolete, vittæ 1 in the furrows.

More or less decumbent, stoloniferous. Peduncles 3-6" 1. *stolonifera*.
Erect without stolons. Peduncles under 3" or umbels subsessile 2. *benghalensis*.

1. *C. stolonifera*, Wall.

A glabrous herb with stout fistular more or less decumbent stems about 2 ft. long with long stolons, 1-2-pinnate leaves with sheathing bases and leaf-opposed umbels 3-4" diam. of small white flowers. Peduncles 3-6" long or more.

Marshy places and river banks. Neterbat 3000 ft. Fl. May-June.

Lower leaves with 5-7 pairs of pinnae, petioled above the sheath, upper leaves sessile on the sheath which has scarious margins, radical leaves (with petiole) about 1 ft. long, pinnae with 3-5 leaflets; lfts. lanceolate or rhomboid-lanceolate with cuneate base, incised or serrate. Bracts 0. Rays many 5-1.5". Bracteoles about 9 linear, shorter than the pedicels. Calyx with 5 subulate teeth nearly as long as ovary, which is slightly laterally compressed without prominent ridges. Pet. white with a long inflexed cusp. Anthers pale pink. Inner fls. male, outer female with longer erect styles. Cocco 12" long. Seed terete.

2. *E. benghalensis*, Benth.

A less stout plant than the last, without stolons. Lfts. generally smaller only '25-1" long, of the lower leaves ovate, of the upper lanceolate. Peduncles short or 0. Rays of umbel few, about 4-6 only, usually under '75" long. Cocci '1" or less.

Sides of muddy rivers. Purneah.

8. *FENICULUM*, Adans.

Tall glabrous herbs with pinnately-decompound leaves, the ultimate segments linear or capillary. Bracts 0, bracteoles few small linear or 0. Sepals 0. Petals yellow emarginate with a short obtuse point. Disc large, lobes conical. Fruit oblong or somewhat ovoid-oblong, sub-terete with broad commissure, primary ridges stout sub-equal, furrows 1-vittate. Seed furrowed, flat or concave on the inner face.

1. *F. vulgare*, Gaertn. Syn. *Anethum* Panmori, Roxb.; Panmohari, Beng.; Saunf, H.; Fennel.

Perennial, or in India, annual, 2-3 ft. high, glaucous, with a characteristic aromatic smell, stems terete, striate, polished, almost solid. (Roxburgh says not striated as in *Dill* and *Sowa*.) Leaves divided into filiform segments, ultimate '5-1'5" long with no petiole above the large sheath or up to '5". Rays 10-25, 1-1'75" long with 10-30 pedicels. Stamens much longer than the petals. Ovary oblong. Fruit variable in length, usually about '2-3" oblong with strong ridges and a conspicuous vitta between each running the whole length of the carpel. There are also two vittæ on the inner face.

Often cultivated.

The striking, more than superficial resemblance of this plant to *Pucedanum graveolens* justified Roxburgh in placing them in one genus, and almost suggests that the taxonomic value of the shape of the fruit has been here carried too far in so widely separating the two species. Except in fruit the Indian *Fennel* and *Dill* more closely resemble one another than do the Indian and European Fennels.

9. *LIGUSTICUM*, L.

Perennial with 1-3-pinnate or twice 3-partite leaves, ultimate pinnae large. Bracts 0-many, bracteoles many. Sepals 0. Petals obovate emarginate, white. Fruit ovoid or ellipsoid with broad commissure, cocci plane on the inner face, dorsally sub-compressed with very prominent primary ridges which are often sub-alate, dorsal furrows 1-3-vittate (on same plant), lateral furrows usually 3-vittate, commissure with several vittæ.

1. *L. alboalatum*, Haines (*Journ. As. Soc. Beng.*, xv, No. 7, p. 314).

A Parsley-like stout herb 3-4 ft. high with fistular striate stems and long-peduncled terminal umbels 2-3'5" diam. of small white flowers giving place to whitish conspicuously 10-ridged or -winged fruit '2" long much dorsally compressed.

Wet places, Neterhat Plateau, 3000 ft. Fl. May. Fr. June.

Rootstock large white. Radical leaves 4-10' long excluding the petiole which is as long, oblong-lanceolate in outline, 2-pinnate with the ultimate segments pinnatifid or incise-serrate with linear-lanceolate lobes or teeth; pinnae 5-7 prs. 1-3' long.

lobes or teeth aristulate, nearly glabrous; cauline leaves often sessile on the large membranous sheaths, pinnae with narrow segments, often lanceolate or lobed. Peduncles pubescent above. Bracts 0-2 linear. Rays over 12, hispidulous on the upper surface, 7-1 25" long. Bracteoles about 9 linear unequal. Petals .05" obovate with keeled face and inflexed tip. Pollen blue. Ovary at first somewhat laterally compressed with strong ridges. Fruit 17" broad, lateral ridges alate and 3 dorsal ridges sub-alate. Vittæ 1-3 in the dorsal furrows.

10. PEUCEDANUM, L.

Perennial rarely annual herbs with 1-3-pinnate or 1-3-partite leaves, ultimate segments lanceolate or ovate, rarely (*P. graveolens*) filiform, sometimes toothed. Rays of umbel numerous, bracts various or 0, bracteoles many-0. Fls. often polygamous, yellow (in our species) or white. Sep. 0 or small. Petals obovate, emarginate or 2-fid. Ovary glabrous rarely pubescent. Fruit much dorsally compressed, ellipsoid, oblong or orbicular, more or less winged on the lateral ridges which are closely appressed face to face, other ridges little elevated fine or obsolete, dorsal furrows 1-vittate, lateral 1-rarely 2-vittate. Seed much dorsally compressed, inner face plane.

- A. Leaves cut into filiform segments 1. *graveolens* (sowa).
B. Leaf segments not filiform.
1 Ovary glabrous.
Cauline leaves pinnate, lfts. entire 2. *dhana*.
Lower cauline leaves 2-pinnate, lfts. deeply serrate 3. *nagpureuse*.
2. Ovary pubescent. Lfts. ovate inciso-serrate 4. *salicum*.

1. **P. sowa**, Kurz. Syn. *P. graveolens*, Benth. (in part); *Anethum Sowa*, Roxb.; Vern. Sowa, H.; *Salpha, sowa*, Beng.; Dill.

A graceful annual 2-3 ft. high with striated darker and lighter green stems covered with a whitish bloom and decompound leaves cut into filiform segments. Fls. yellow in umbels 1.5" diam., often enlarging to 3.5" diam. in fruit. Pedicels 1-2" long, slender. Peduncles 1-5".

Often cultivated. Fl., Fr. c.s.

Perhaps not more than a tropical variety of *P. graveolens*, differing only in the more delicate growth, in the fruit being somewhat smaller .12-.14" by .07", the mericarps more convex, marginal wings narrower and firmer and the ribs more prominent.

It exceedingly resembles the *Fennel* both in foliage and flower, and apart from the hypanthium and fruit good discriminating characters are difficult to define. The ultimate leaf segments are usually only 1-5" long, those of *Fennel* usually 4-15" long. Hypanthium of *Fennel* in full flower .05-.06" soon elongating to .15-.2" in fruit, with conspicuous raised ribs (ridges); in *Dill* the flowering hyp. is .02-.03" elongating to .12-.14", and except the marginal wings the ribs or ridges are not obvious till the seed is nearly ripe and are then scarcely raised.

The seeds are used in medicine and in cookery.

2. **P. dhana**, Ham. Var. *Dalzellii*, Clarke.

A glaucous glabrous herb with flowering stems 1-2 ft., but with leaves chiefly radical 3-partite or simply pinnate with 3-5 thick oblong to lanceolate 3-nerved leaflets 2-3.5" by 3-7". Flowers small yellow in umbels with unequal and often very long rays attaining 5" in fruit. Coccoi ellipsoid .25"-.35" by .25".

High plateau lands of Chota Nagpur! Fl. March-May. Fr. May-June. Leaflets entire (rarely toothed?). Rays of umbel 5-10, some attaining 5" long in fruit. Bracts 3-6 linear acuminate. Pedicels numerous. Bracteoles 4-8. Sep.

minute triangular or obsolete. Disc yellow and glandular. Fil. long. Ripe carpels compressed, usually '25-3" long, broadly oblong, laterally winged, with 3 fine distinct narrow ridges on dorsal face, slightly emarginate both ends.

The typical *P. Dhana* has more compound leaves with narrower leaflets; variety *Dalzellii* is described by Clarke as having leaflets shortly oblong or even sub-orbicular.

3. *P. nagpurensis*, Prain. Syn. *P. glaucum*, DC., var. *nagpurensis*, Clarke; Epondom, oponom, K., S.; Trio-singhi, Birja.

An erect stout herb 3-4.5 ft. high with a fusiform root and striate polished stems. Leaves twice ternately compound with leaflets on the lower leaves very large ovate acuminate and strongly serrate, upper lanceolate to linear and uppermost occasionally filiform. Flowers green or brownish, petals oblong-lanceolate with an inflexed tip. Cocco elliptic oblong '3-4" long, broadly winged, the wings projecting both ends, dorsal ridges fine but distinct.

In the forests, frequent in the mountains of Singbhum, Palamau and Manbhum! Common in Koderma (Hazaribagh). Neterhat! Angul, Chattarjee! Fl. Oct.-Nov. Fr. Dec.

Leaflets of lower leaves 3-6" long by 2-3.5" broad, with straight or rounded or, in terminal, sometimes rhomboid base, nerves strong, tertiaries reticulate, impressed above, raised beneath. Lower petioles 8-12" long. Umbels 2-3" diam. in flower or 4" in fruit, more regular than in *P. dhana*, rays about 12, '25-1.5"', bracts 0-1 oblong with a long setaceous point, '3". Pedicels 14-25, bracteoles 3-4, setaceous, '25-3"', spreading and reflexed in fruit. Sepals short truncate mucronate. Stamens often only 2 perfect.

The stems are used for shepherds' pipes or flutes (rotu, K., trio, Birja). The root is used as a stomachic.

4. *P. sativum*, Benth., is the Parsnip, only cultivated, I believe, in the gardens of Europeans.

11. CORIANDRUM, L.

Only one species.

1. *C. sativum*, L. Dhaniya, H.; Coriander.

An annual slender-branched glabrous herb with a disagreeable odour, with pinnately decomposed leaves, leaflets of lower leaves ovate lobed and crenate, upper linear. Flowers white or pinkish, outer radiant in compound umbels with few, 5-10, rays, bracts 0, bracteoles few filiform, sepals acute, petals emarginate with inflexed point. Fruit globose with the 4 secondary ridges on each coccus somewhat stronger than the 5 primary which are often inconspicuous wavy lines, vittæ obscure, solitary under each secondary ridge and two vittæ on the concave commissural surface; diam. of fruit about '2" but rather variable.

Rather widely cultivated in the gardens of Indians and often self-sown. The fruits are much used in curries. They yield Oil of Coriander which is stimulant, aromatic and carminative and is officinal.

12. DAUCUS, L.

1. *D. carota*, L. Gajur, H.; The Carrot.

Small country carrots are largely grown in Chota Nagpur with a white or purplish root very different in appearance from the European garden carrot, which, however, succeeds well in the cold season and on the plateau lasts throughout the hot weather.

The cocci have the four sec. ridges hispid with bristles and the 5 smaller primary with smaller sub-gloccidiate hairs.

75. ARALIACEÆ.

FAM. 75. ARALIACEÆ.

Trees or shrubs (never herbs in our area) sometimes scandent, often but little branched, frequently prickly. Leaves always palmately-nerved if simple, usually palmately compound or pinnate, sometimes decomposed, alternate, with stipules more or less adnate to the petiole or 0. Flowers regular, small, sometimes polygamous, in dense umbels, umbels usually racemed or paniced. Calyx superior, reduced to a raised margin with sepals small or obsolete. Petals 5 or 6-7 or more, valvate or sub-imbricate, sometimes calyptrate, inserted with the stamens round or under the margin of an epigynous disc. Stamens as many as and alternate with the petals.* Ovary inferior, 2-many-celled, styles as many as the cells, distinct or united. Ovules solitary, pendulous in each cell. Fruit coriaceous or drupaceous, one or more cells sometimes suppressed. Seed pendulous, albumen uniform or ruminant. Embryo minute, radicle next the hilum.

- I. Petals lightly imbricate, pedicels jointed.
Shrubs (in our area)† with compound leaves 1. *Aralia*.
- II. Petals valvate.
 - A. Albumen uniform.
 1. Ovary 2-celled. Cultivated shrub, leaves 2-3-pinnate 2. *Panax*.
 2. Ovary 4-10-celled.
Large climber. Leaves digitate 3. *Heptapleurum*.
 - Small tree. Leaves palmate or digitate 4. *Trevesia*.
 - B. Albumen ruminant. Ovary 2-celled. Small trees,
Leaves pinnately decomposed 5. *Heteropanax*.

1. ARALIA, L.

Herbs, shrubs or small trees, often hairy or prickly. Leaves alternate or whorled, digitate pinnate or 2-3-pinnate with serrate or nearly entire leaflets, stipulate. Umbels variously arranged. Fls. often polygamo-dioecious. Calyx margin truncate or 5-sepalous. Petals 5 ovate, lightly imbricate in bud. Ovary 2-5-celled with 2-5 styles. Fruit 4-5-celled and -angular or subglobose and 2-3-celled. Albumen uniform.

1. *A. armata*, Seem.

A small very prickly unbranched tree or shrub with large 2-3-pinnate hairy leaves 2-3 ft. long with prickly rhachis and secondary rhachides. Stipules 1-2" intrapetiolar. Lower pinnae about 9" long. Pinnae about 5 pairs with subsidiary pinnae or leaflets at their base, lowest pinnae about 9" long and the next higher pair somewhat longer, pinnules or leaflets softly hairy, about 6 pairs on the longer pinnae and a terminal, ovate, caudate, 2-3·5" long, petiolules 0-4".

Simlipahar Mountains in Mayurbhanj, above 3000 ft. ! Fl., Fr. Aug.-Dec.
Lfts. finely serrate. Panicle often 1·5 ft. long, upper part and pedicels pubescent, bracts caducous (or 0?), pedicels 5-75" unequal. Fls. about 1" diam. without the petals which are usually reflexed and 1" long, white. Fr. 3" long ellipsoid or subglobose, sharply 5-angled (at least when dry).

* Numerous in *Tupidanthus*, a small tree sometimes seen in gardens.

† The above Key is only applicable to the genera so far as they are represented in Behar and Orissa, e.g. *Aralia* also contains herbs and small trees and *Heptapleurum* contains large trees. The limits of the genera have, however, been very considerably changed by different authors.

Several species of so-called *Aralia* are grown in gardens for their ornamental foliage, but these plants sometimes belong to other genera. The flowers are usually greenish and insignificant from a horticultural standpoint.

2. PANAX, L.

Shrubs or trees with pinnate or digitate or 2-3 pinnate leaves and entire or serrate leaflets. Umbels paniced, pedicels jointed under the flowers which are often polygamous. Calyx-limb 5-toothed or nearly entire. Petals 5 valvate. Ovary 2- rarely 3-celled, styles distinct. Fruit with as many seeds as cells.

N.B.—*Panax* as here defined is the genus of that name in the *Genera Plantarum* and F.B.I. Harms in *Nat. Pflanz. Fam.*, taking the Ginseng section of *Aralia* as the true genus *Panax*, includes the Linnean *P. fruticosum* in the genus *Polyscias*.

1. *P. fruticosum*, L. Syn. *Polyscias fruticosa*, Harms; *Nothopanax fruticosum*, Miquel.

A shrub with 2-3-pinnate leaves and toothed leaflets. Fls. very small yellow in umbels .3" diam. Calyx .04" long, corolla caducous. Styles 3 recurved. Fr. '15".

Found as a pot plant in nearly every Indian verandah. Native of Java. The leaves are excessively variable. In var. *multifidum* they are decompound and very finely cut.

2. *P. cochleatum*, DC., with simple often spoon-shaped leaves belongs to the genus *Nothopanax*, which is distinguished by the leaves being simple, lobed or digitate.

NOTE:—A very common plant in Indian verandahs and gardens with simply pinnate leaves and leaflets with a white margin may also be a *Panax*. I have never seen it in flower.

3. HEPTAPLEURUM, Gaertn.

(*Schefflera*, Forst., Section *Heptapleurum*, Harms in *Nat. Pflanz. Fam.*)

Trees or large shrubs, sometimes scandent, without prickles. Leaves digitate with coriaceous entire or sub-entire leaflets, rarely uni-foliolate or twice digitate. Umbels paniced or in branched racemes, bracts woolly, pedicels not jointed under the flower. Flowers 5-10- usually 5-6-merous (including the carpels). Style very short clavate or scarcely developed, the broadly conical top of the ovary being apparently stigmatic. Fruit sub-globose, 5-6-angled. Seeds compressed, albumen uniform.

1. *H. venulosum*, Seem. Syn. *Schefflera venulosa*, Harms; Sukriruya, Sukriran, K.; Sunumjur, S.; Ban-simar, Beng.; Jari, Or.; Sapruria (Bonai, Cooper).

A large climbing or epiphytic shrub attaining 3 ft. girth with digitate 5-7-foliolate leaves and yellow flowers in paniced umbels.

Climbing on trees and rocks in the more humid parts of the province or in the mountainous districts, frequent. Throughout Chota Nagpur ascending to the top of Parasnath! Santal Parganas! Puri! Mayurbhanj! Bonai, Cooper! Angul, common! Sambalpur! Fl. May-June. Fr. r.s.

Clarke says (*Journal L.S.*, xxi, 252): "I noticed that *Heptapleurum* commences its life here (i.e. Parasnath) as a scandent epiphyte, but subsequently reaching the ground, it grows to a large size as a tree, and shows no signs of its early history."

HEPTAPLEURUM.]

75. ARALIACEÆ.

Lfts. unequal 2-6" by 1-2" elliptic-oblong acuminate glabrous rather coriaceous, sec. n. 3-4 rather strong but not much stronger than intermediate, tertiary reticulate. Petioles 3-2". Petiolules 1-4" long. Stipules connate within the petiole. Panicles glabrous. Umbels 3-4" diam. racemed on the 5-8"-long branches of the short panicle. Bracteoles 0. Calyx truncate. Petals 5-6, 3-nerved. Style 0.

Var. **Roxburghii**. Syn. *Schefflera Roxburghii*, *Gamble*; *Aralia digitata*, *Roxb.*

This is distinguished from *H. venulosum* by the less leathery leaves, main nerves scarcely more prominent than the secondary and reticulations, not very oblique, about 60 degrees with the midrib, panicles with a rather long rhachis (*Gamble*), whereas *venulosa* has the main nerves far the most prominent, very oblique, about 30 degrees with the midrib, panicles with a short rhachis (*teste Gamble*).

Perhaps also the petals are more caducous and narrow-oblong compared with the ovate petals of *venulosa*, but although one of the two species or varieties is very common, neither has been sufficiently collected to indicate their relative distribution. A specimen from Parasnath summit has been named *Roxburghii* at Kew. Its leaflets are broadly elliptic and venulose.

4. TREVESIA, Vis.

Shrubs or small trees, often prickly and sometimes stellately hairy. Leaves palmate or digitate or the petiolules united by a foliaceous wing, stipules intrapetiolar or obsolete. Flowers polygamous, rather large for the family, in paniced umbels. Calyx-margin entire or toothed. Flowers 8-12-merous, ovary with as many cells as the petals, styles united into a small boss or short column. Fruit ovoid. Seed compressed, albumen uniform.

1. **T. palmata**, Vis.

A small erect scarcely-branched soft-wooded prickly tree 10-20 ft. high with the young parts covered with a reddish tomentum. Leaves large sub-orbicular, palmate with the leaf lobes deeply gashed or with sharp lanceolate lobules which are rather shallowly serrate. Flowers white in large drooping panicles composed of numerous umbels 2-4" diam.

Valleys north of Bettiah and in the Ramnagar Hills! Purneah, near the northern boundary! Valleys in Singhbhum (e.g. *Jui gara* in the Leda Forest), very rare! Fl. Jan.-March. Fr. May-June.

Leaves 1-2 ft. diam. with cordate base, divided about or rather more than half-way down into about 9 lobes, beneath with stellate tomentum gradually glabrescent. Petioles 2-3 ft. prickly towards base. Panicles 18" long. Bracts about 1". Fls. 25-40 in an umbel, buds 4" diam., the ribbed corolla 8-10-petalous often calyptrate, calyx with wavy margin. Peduncles of umbels attain 4". Fruit broadly oblong-ovoid, truncate or sub-globose, .65" diam., ribbed when dry.

5. HETEROPANAX, Seem.

An unarmed small tree with very large pinnately decomposed leaves and large panicles with the umbels racemose on the branches, bracts small ovate persistent, pedicels not jointed under the flower. Fls. polygamous, calyx-margin nearly entire. Petals and stamens 5. Ovary 2-celled with 2 distinct styles. Fruit much laterally compressed, 2-seeded. Seeds compressed, albumen ruminated.

1. *H. fragrans*, Seem. Rengebanam, K. (the name given to *Oroxylum indicum*, which it superficially resembles).

An erect small tree up to 2 ft. girth with enormous tri-pinnate leaves 3-4 ft. long and 2-3 ft. across, elliptic or ell.-ovate glabrous entire leaflets 3-7" long, or the terminal attaining 9" by 4.5". Flowers small yellow in umbels racemed on the branches of an erect panicle 18"-2 ft. long which is covered with a deciduous rusty stellate scurf or tomentum. Fruit closely resembling that of an Umbellifer but not splitting into mericarps, strongly compressed at right angles to the septum, 4" diam.

- Rather frequent in the more humid districts or among mountains. * Champaran! Chota Nagpur, frequent in valleys near streams and on the cool sides of hills! S.P., very common on north aspects on the trap of the Rajmahal Hills! Angul! Fl. Dec. Fr. Feb. Evergreen.

The pinnae are sometimes 4-5-nate together with a single leaflet at the nodes of the main leaf rachis. Lifts. 1-7 on the ultimate pinnules with base usually somewhat oblique and rounded, apex shortly acuminate. Styles spreading.

Var. *serrata*, Haines. Lifts. ovate-lanceolate caudate, sharply, almost sub-spinulose, serrate. Bark rugose, blaze soft white with indistinct spots.

Near streams in the mountains, Southern Range, Palamanu!

FAM. 76. CORNACEÆ (Tribe Alangioideæ).

Trees or shrubs, sometimes thorny, with alternate entire or lobed often palmately-nerved exstipulate, sometimes gland-punctulate leaves. Flowers white or cream-coloured, regular, 2-sexual in axillary fascicles or cymes. Calyx superior, usually feebly developed, reduced to a marginal rim on the hypanthium or with 4-10 teeth. Petals 4-10 linear or somewhat lanceolate, valvate in bud, free or somewhat connate at the base. Stamens epigynous as many as the petals or 2-4-times as many, sometimes adnate and inserted with them between the calyx-rim and the disc at the base to the petals, connective elongate and anthers narrow adnate. Disc epigynous swollen. Ovary completely inferior and adnate to the hypanthium 1-2-celled. Style inserted in the middle of the disc, with usually 2-seldom 3-lobed stigma, the lobes lobulate at the margin. Ovule 1 pendulous from the top of each cell, compressed, micropyle superior usually lateral. Fruit a drupe crowned by the calyx usually 1-seeded. Seed with thick testa and fleshy albumen, cotyledons foliaceous palmately-nerved, thin with cordate base, radicle long terete.

1. ALANGIUM, Lamk. (including Marlea, Roxb.).

In the F.B.I. *Marlea* is separated from *Alangium* by the characters of having stamens equalling the number of petals and by the flat cotyledons, whereas the cotyledons of *Alangium* were said to be crumpled and the albumen ruminant. As noted in my *Flora of Chota*

Nagpur the cotyledons of *A. Lamarckii* are flat and the albumen not ruminate and I therefore follow Harms in bringing our species of *Marlea* under *Alangium*, the characters of which are as above.

Leaves oblong or elliptic. Fls. fascicled 1. *Lamarckii*.
 Leaves broad, often lobed. Fls. in cymes 2. *begoniæfolium*.

1. **A. Lamarckii**, Thw. Syn. *A. hexapetalum*, Lamk. & DC.; Arkol, K.; Dhela, S., Kharu.; Akola, H.; Ankula, Dolanka, Ur.; Akar-kanta, Beng.; Kumri, Mal P.

A bushy tree, usually small and thorny, with oblong, oblong-lanceolate, or elliptic leaves 3-6" by 1-2" pubescent all over when young. Flowers m.s., white in axillary fascicles or from the axils of fallen leaves with 5-10 petals 5-9" long, recurved or revolute after expanding. Stamens 20-30 very villous below. Fruit 3-75" subglobose or ellipsoid, black, succulent with bony endocarp, crowned by the calyx, appearing ribbed when dried.

A common tree but rather locally abundant. It prefers the well drained sides of nalas but is often found in waste ground. Champaran, in mixed forests near rivers! Extending south and south-east to Monghyr and Santal Parganas! Common in Chota Nagpur! Puri! Mayurbhanj! Angul! Orissa States, common, Cooper! Sambalpur, local! Fl. March-May. Fr. June-July. More or less leafless at the time of flowering. New leaves appear May-June. Some trees are very beautiful when covered with their masses of sweet-scented flowers, others flower sparsely.

Attains 4 ft. girth in favourable localities (near rivers) but no great height, rarely 30 ft. Bark light-coloured, somewhat flaking, blaze cream-coloured. Leaves with sometimes unequal base which is 3-nerved or the first pair of sec. n. is close to the base, other sec. n. about 5 and tertiaries more or less parallel, upper surface with pubescent nerves, beneath sparsely hairy and with gland pits or tufts of hair in the nerve axils; when fresh the leaf is also minutely pellucid-punctulate. Petiole 25". Hypanthium usually broadly cup-shaped in flower with 5-6 pubescent teeth. Cotyledons with 3-nerved base.

In Monghyr is a form with leaves over 6" long and ovate-lanceolate, very pubescent beneath.

Dhela wood is strong and is much used for agricultural implements. The bark and root are used in jaundice, the seed for the cure of boils (in Sambalpur). The fruit is eaten.

2. **A. begoniæfolium**, Harms. Syn. *Marlea begoniæfolia*, Roxb.; Timil, Akhani, Nep.

A small thin-crowned tree with spreading long branches on which the large leaves are often distichously arranged. Leaves ovate and entire to sub-quadrate and with large lobes, 4-8" long, young villous, old glabrous or nearly so above, pubescent on the nerves beneath and with tufts of hairs in the nerve axils, basal nerves 3-5. Flowers cream-coloured in 2-chorotomous cymes 2-3" long. Calyx minutely toothed, petals 6-8, stamens as many with short stout very villous filaments and long anthers. Fruit broadly ellipsoid 3", not ribbed when fresh, seed slightly grooved, 25", black on both faces with a lateral white band.

Northern Purneah! Fl. June. Fr. Aug. Decid. Jan.-March.

HS